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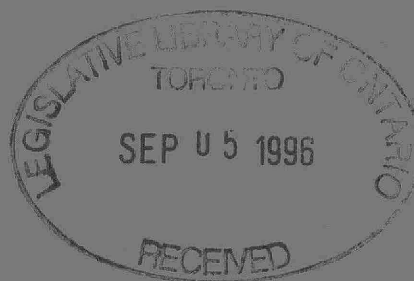
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## TECHNICAL MEMORANDUM

# AMBIENT AIR QUALITY SURVEY IN HAMILTON, ONTARIO 1985

ARB-84-86-AQM

April, 1986



Ontario

Ministry  
of the  
Environment

Dr. David Balsillie, Director  
Air Resources Branch

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**TECHNICAL MEMORANDUM  
AMBIENT AIR QUALITY SURVEY  
IN  
HAMILTON, ONTARIO 1985**

**ARB-84-86-AQM**

Prepared for  
The West Central Region  
Ministry of the Environment

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Ministry of the Environment

April, 1986

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1. EXECUTIVE SUMMARY

Between October 15th and November 6th, 1985 an intensive ambient air quality survey was undertaken in the downtown Hamilton area by mobile air monitoring units #1 and #2 of the Air Resources Branch. As per the request of the West Central Regional office, air quality profiles were established under adverse weather conditions and in the vicinity of several 'targeted' sources in the industrial complex along Burlington Street. In particular, the adverse weather condition was that of daytime inversions and nocturnal inversions and the 'targeted' sources were Domtar, Stelco, Dofasco, Columbian Chemical, and the Sewage Treatment plant on Woodward Avenue. In addition, 4 long-term monitoring sites were also utilized in order to determine general air quality profiles throughout Hamilton - these were the Harvester site at the north end of Sherman Avenue, Pier 24/25 at the north end of Strathearne Avenue, the Public Works Department in the Chedoke area and Mohawk College area on Fennell Avenue.

The Domtar results were released to the West Central Region in a separate Air Resources Technical Memorandum (#ARB-219-85-AQM) in December of 1985. This memorandum deals with the remaining requests.

The results of some 64 different monitoring periods are summarized in this technical memorandum during which approximately 860 hours of common contaminant data (i.e. for CO, TRS, SO<sub>2</sub>, NO<sub>x</sub>, O<sub>3</sub> and THC) and 82 gas chromatographic samples for specific hydrocarbons analyses were acquired.

From all of the common contaminant data acquired downwind of the 'targeted' sources, some elevated concentrations of CO, TRS, SO<sub>2</sub> and NO<sub>x</sub> were measured. In particular, Dofasco was deemed to be a major source of TRS and NO<sub>x</sub> (the respective maximum 30-minute average concentrations being 0.027 and 0.24 ppm), Stelco a major source of TRS, SO<sub>2</sub> and NO<sub>x</sub> (the respective maximum one-hour average concentrations being 0.087, 0.15 and 0.22 ppm) whereas for the other sources, i.e. Columbian Chemical and the Sewage Treatment plant, low concentrations were measured. The steel plants and vehicular traffic also contributed significantly to the downtown concentrations of CO - the normal concentration level for this contaminant was usually in the range of several ppm.

From the gas chromatographic analyses, usually only 40 to 60 specific organic compounds were identified and quantified with the averaged total hydrocarbon loadings ranging up to  $500 \text{ ug/m}^3$ . These loadings were usually dominated by a uniform alkane fractional component (up to approximately  $200 \text{ ug/m}^3$ ) that could be attributed to the use of fossil fuels - especially vehicular exhaust. The aromatic fraction accounted for the most variability in these loadings (average loadings ranging between 40 and  $300 \text{ ug/m}^3$ ) and the most dominant sub-group of this fraction was the BTX's (benzene, toluenes and xylenes) with individual loadings usually less than  $50 \text{ ug/m}^3$ . Very little chlorinated organics were detected in any of these samples - usually less than  $10 \text{ ug/m}^3$  in total.

The emissions from the Burlington Street industrial complex were measured at all sites during this survey. Strictly speaking, none of the applicable environmental standards, criteria or guidelines were exceeded at any time for any of the measured contaminants detected during this survey. However, the guideline for total reduced sulphur compounds which was developed to control emissions from kraft pulp milling operations was approached and exceeded downwind of Dofasco and Stelco respectively.

## 2. INTRODUCTION

At the request of the West Central Region, via Mr. K. Trent, Mobile Air Monitoring Units #1 and #2 (MAMu#1 and #2) of the Monitoring and Instrumentation Development Unit of the Air Resources Branch undertook a 3-week ambient air monitoring survey in the Hamilton area during the last half of October, 1985. The main aim of this survey was to establish general air quality parameters in the downtown core of Hamilton and if conditions were applicable, investigate the gaseous emissions originating from several targeted sources within the Hamilton industrial complex.

The data acquired during this survey will be presented according to meteorological conditions (inversion and overnight monitoring), site selections (Pier 24/25 site, Harvester site, Chedoke Public Works site and the Mohawk College site) and 'targeted' source investigations (Stelco/Dofasco, Columbian Chemical, Sewage Treatment Plant and the Domtar (Cassidy Works) Tar Plant). The results obtained in the vicinity of the Domtar Tar Plant were published separately in Technical Memorandum #ARB-219-85-AQM. This memorandum was presented to the West Central Region in December of 1985.

The instrumentation of MAMu #1 and #2 is presented in Tables #1 and #2 and the monitoring periods, sites and source (general) areas are listed in Tables #3 and shown on Maps #1. It will be noted in Tables 1 and 2 that the common contaminants monitored were total reduced sulphur compounds (TRS), sulphur dioxide ( $\text{SO}_2$ ), oxides of nitrogen ( $\text{NO}_x$ ), nitrogen dioxide ( $\text{NO}_2$ ), nitrogen monoxide (NO), carbon monoxide (CO) and ozone ( $\text{O}_3$ ) and all of these contaminants were monitored on a continuous basis.

The analyses/measurements of organics (some being odourous compounds) were performed by dual capillary-column gas chromatographs (GC) prefaced by Trace Organic Preconcentrators (TOP). Ambient air was drawn through the TOP and the organics were adsorbed onto Florisil/Molecular Sieve/Spherocarb cartridges (usually for one or one-half hour) and then thermally desorbed and introduced on the column heads of the GC. It should be noted that the organic analyses were performed on discrete ambient air samples. In addition, total hydrocarbon monitoring was also accomplished by other dedicated instrumentation housed in MAMu #1 and #2. These were dual flame ionization detector systems capable of monitoring total hydrocarbon concentrations along

with their methane and non-methane hydrocarbon fractions. These latter instruments were used primarily as quantitative backups for the GC sampling and analytical programmes.

TABLE #1

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #1

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH <sub>4</sub> , TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH <sub>4</sub> )
H <sub>2</sub> S, SO <sub>2</sub> , NO <sub>x</sub> sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS/SO <sub>2</sub> analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	1.0 ppm SO <sub>2</sub> 0.5 ppm TRS
NO <sub>x</sub> , NO <sub>2</sub> , NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NO <sub>x</sub> (as NO <sub>2</sub> )
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO
O <sub>3</sub> analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O <sub>3</sub>
CO & THC sources	Matheson	Compressed Gas	N/A
Gas Chromatograph	HP 5880 Dual Capillary Column	Flame Ion-ization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm <sup>2</sup>

\*\* These instruments are located on top of a 10 metre retractable tower

TABLE #2

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #2

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH <sub>4</sub> , TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH <sub>4</sub> )
H <sub>2</sub> S, SO <sub>2</sub> , NO <sub>x</sub> sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	0.5 ppm H <sub>2</sub> S
SO <sub>2</sub> analyzer	Hartmann & Braun Picoflux 2T	Conductometric	3.0 ppm SO <sub>2</sub>
NO <sub>x</sub> , NO <sub>2</sub> , NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NO <sub>x</sub> (as NO <sub>2</sub> )
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO
O <sub>3</sub> analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O <sub>3</sub>
CO & THC sources	Matheson	Compressed Gas	N/A
Gas Chromatograph	HP 5880 Dual Capillary Column	Flame Ionization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmbH	km/hr
** Wind direction	Lambrecht GmbH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm <sup>2</sup>

\*\* These instruments are located on top of a 10 metre retractable tower

**TABLE 3**  
**MONITORING SITES DURING HAMILTON '85 SURVEY**

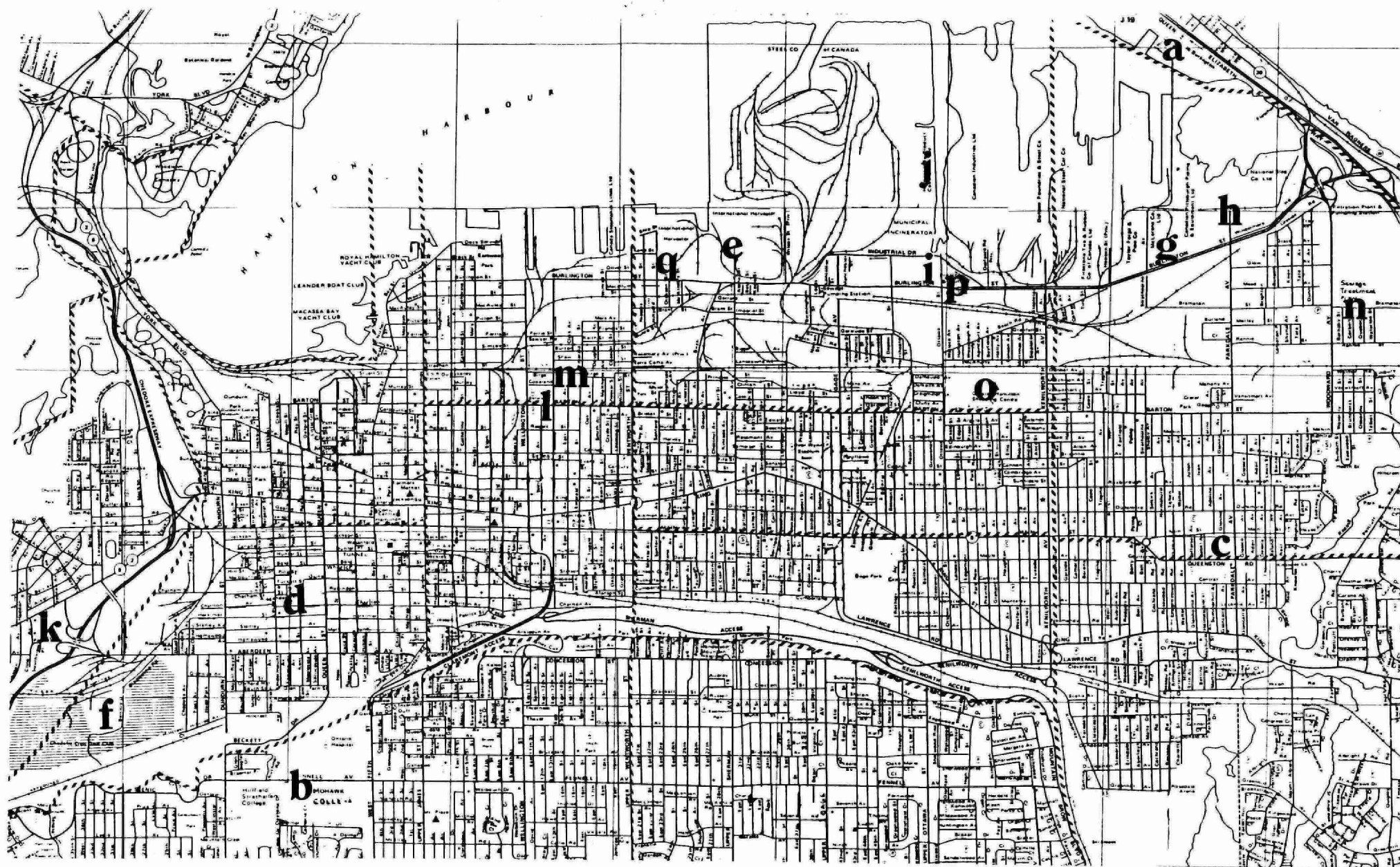
Monitoring Period	Date	Start Time	Duration (Hr)	#GC Samples	MAMu	Source(s)	Map ID
A151	10/15	18:25	14.4	0	1	Pier 24/25	a
A163	10/16	14:19	22.1	3	1	Pier 24/25	a
B163	10/16	16:50	16.2	0	2	Mohawk	b
A172	10/17	13:33	1.2	2	1	Inversion	c
A173	10/17	15:48	1.1	2	1	Inversion	d
A174	10/17	17:45	15.7	0	1	Inversion	a
B171	10/17	11:09	6.1	4	2	Inversion	e
B172	10/17	17:19	16.0	0	2	Harvester	e
A181	10/18	10:32	1.8	3	1	Columbian	g
A183	10/18	15:48	65.8	0	1	Pier 24/25	a
B181	10/18	11:15	1.1	1	2	Columbian	h
B183	10/18	16:19	22.8	0	2	Harvester	e
B192	10/19	15:30	29.5	0	2	Harvester	e
B201	10/20	19:51	16.1	0	2	Harvester	e
A212	10/21	11:03	1.6	2	1	Pier 24/25	a
A213	10/21	13:31	2.9	5	1	Dofasco	i
B211	10/21	11:55	1.4	1	2	Harvester	e
B212	10/21	13:57	2.0	2	2	Dofasco	j
B213	10/21	16:52	16.3	1	2	Mohawk	b
A222	10/22	11:21	1.3	1	1	Inversion	k
A223	10/22	13:30	1.2	1	1	Inversion	c
A224	10/22	15:44	3.8	7	1	Inversion	a
A225	10/22	19:34	13.8	0	1	Pier 24/25	a
B221	10/22	09:52	1.7	1	2	Mohawk	b
B222	10/22	12:44	1.1	1	2	Inversion	l
B223	10/22	14:07	1.1	1	2	Inversion	m
B224	10/22	16:13	3.0	3	2	Inversion	e
B225	10/22	19:14	17.1	0	2	Harvester	e
A233	10/23	12:01	0.9	2	1	Dofasco	i
A234	10/23	13:10	2.3	3	1	Dofasco	i
A235	10/23	16:24	16.3	3	1	P.W.D.	f
B233	10/23	16:03	16.6	2	2	Harvester	e



TABLE 3 (Continued)  
MONITORING SITES DURING HAMILTON '85 SURVEY

Monitoring Period	Date	Start Time	Duration (Hr)	#GC Samples	MAMu	Source(s)	Map ID
A242	10/24	10:20	3.1	0	1	P.W.D.	f
A244	10/24	16:24	16.8	1	1	Pier 24/25	a
B242	10/24	17:09	16.0	0	2	Harvester	e
A252	10/25	16:06	65.3	0	1	Pier 24/25	a
B254	10/25	16:07	66.2	0	2	Harvester	e
A283	10/28	10:13	1.2	0	1	S.T.P.	n
A285	10/28	12:48	3.0	2	1	Pier 24/25	a
A286	10/28	15:46	0.8	1	1	Pier 24/25	a
A287	10/28	17:46	16.3	0	1	P.W.D.	f
B282	10/28	11:04	0.7	1	2	S.T.P.	n
B283	10/28	11:53	1.0	1	2	S.T.P.	n
B284	10/28	14:20	2.2	1	2	Harvester	e
B285	10/28	16:38	16.0	0	2	Harvester	e
A291	10/29	10:39	1.9	2	1	Inversion	o
A292	10/29	12:56	3.2	1	1	Dofasco	i
A293	10/29	16:50	17.5	0	1	P.W.D.	f
B292	10/29	10:11	0.7	2	2	Harvester	e
B293	10/29	11:45	1.3	1	2	Columbian	g
B294	10/29	13:34	2.1	2	2	Dofasco	j
B295	10/29	16:09	19.2	0	2	Harvester	e
A301	10/30	11:56	1.8	2	1	Dofasco	p
A302	10/30	13:53	1.8	4	1	Dofasco	i
A303	10/30	16:36	16.1	0	1	P.W.D.	f
B302	10/30	13:07	2.0	1	2	Dofasco	i
B303	10/30	15:22	1.2	1	2	Stelco	q
B304	10/30	16:50	15.8	0	2	Harvester	e
A315	10/31	16:03	16.6	1	1	P.W.D.	f
B315	10/31	16:28	16.1	0	2	Harvester	e
A013	11/01	15:07	65.4	0	1	P.W.D.	f
B014	11/01	15:18	66.2	0	2	Harvester	e
A041	11/04	11:13	23.6	0	1	P.W.D.	f
B043	11/04	15:28	43.4	7	2	Harvester	e

## Monitoring Sites '85 Hamilton survey



### 3 DISCUSSION AND RESULTS

#### 3.1 General Observations

As noted in Table #3, this Hamilton area survey was carried out from October 15th to November 6th inclusive. During this time, Hamilton was also used as a base station for two other ambient air surveys that are not included in this memorandum. These other two surveys were the Oakville Petro-Canada survey and the Hamilton Domtar (Cassidy Works) Tar Plant survey - ARB Report #'s 69-86 and 219-85 respectively. Because of this fact, several dates and monitoring periods (MP) are omitted from Table #3. This technical memorandum will only deal with the data acquired during the times as stated in Table #3.

Thus 64 monitoring periods will comprise this Hamilton survey report during which 860 hours of continuous monitored data were acquired for the 6 to 8 common contaminants and 82 GC samples were acquired and subsequently analyzed for over 120 specific hydrocarbons. It should be mentioned that the field GC's had the potential of identifying and quantifying over 120 specific hydrocarbons but usually only 35 to 50 of these compounds were present in the acquired samples. A second point of note was that the mean percent area identified peak figures as determined from all 136 GC samples was 72% and that usually, for a 'normal' environment, this figure is in excess of 70%. This percentage essentially tells how good of a match was achieved between the GC library compounds and the compounds eluted by the system. Finally, there were 4 pairs of specific organics and each member of the pairs had similar retention indices upon elution from by the GC system. At that time and with the available GC methodology, the positive identification and quantitation of each pair member was ambiguous. All that can be said is that either or both organics may have been present (in each pair) and that a realistic estimate of concentration was given for each member; in particular the pairs were trans-2-pentene and cis-2-pentene, ethylcyclohexane and propylcyclopentane, tert.-butylbenzene and 1,2,4-trimethylbenzene, and 1,4-diethylbenzene and n-butylbenzene. For these 4 pairs, all reported concentrations were usually low and in the range of several  $\mu\text{g}/\text{m}^3$ .

Finally for this sub-section, a word should be mentioned with respect to the prevailing winds and the winds monitored in the downtown core of Hamilton. Several frontal systems pushed through southern Ontario during this 3 week period and northwest to southwest winds were usually recorded at the Hamilton airport. However, as noted from the wind directional frequency analysis (Graphs #1 and #2 on pages 14 and 15) applied to the meteorological parameters acquired in the downtown core of Hamilton (i.e. usually below the escarpment), the recorded prominent wind directions were from the east and southeast. These recordings lend credence to the well-known microscale closed circulation wind pattern of Hamilton; i.e. that set up by the prevailing easterlies or on-shore flow off Lake Ontario at low elevations, orographic lift by the escarpment and finally reverse/return circulation by the prominent westerlies above the escarpment to be followed by subsidence by the cooler air over Lake Ontario.

# HAMILTON\_85: MA001

Start: 85/10/15 18:20 Scan: 300 sec. Ave: 60.0 min. Duration: 524.7 hrs.

Loc: Merging all the data acquired by MAMu#1

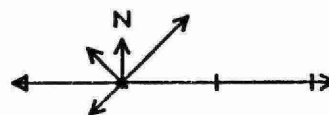
WINDS Blowing From

1 Division = 10% of Time

Calm ( < 3 km/hr) = 17.9%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%



Wind Rose

# HAMILTON\_85: MB001

Start: 85/10/16 16:45 Scan: 300 sec. Ave: 60.0 min. Duration: 501.8 hrs.

Loc: Merging all the data acquired by MAMu#2

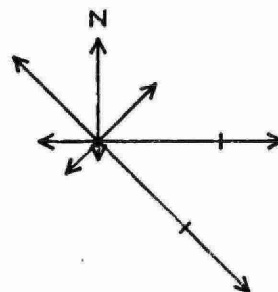
## WINDS Blowing From

1 Division = 10% of Time

Calm ( < 3 km/hr) = 16.6%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%



Wind Rose

### 3.2 Inversion Conditions

October 17, 22 and 29th were considered 'inversion days' in the Hamilton area. Apart from the overnight monitoring on these days, 10 monitoring periods (MP's) were ascribed this characteristic and 22 hours of common contaminant data and 24 gas chromatographic (GC) samples for the specific hydrocarbons analyses were acquired.

From the merged data set of the common contaminants acquired during this time, elevated ground level concentrations (glc's) of CO and NO<sub>x</sub> were measured throughout the entire period. During these 22 hours of data, the overall mean and maximum one-hour average glc's of CO were 1.4 and 3.3 ppm (parts per million) and of NO<sub>x</sub>, they were 0.09 and 0.21 ppm respectively. During 2 of these monitoring periods (i.e. B171 and B224), the MAMu #2 was located at the Harvester site and elevated glc's of SO<sub>2</sub> and TRS were also recorded. During these two periods, the maximum one-hour average glc's reported for SO<sub>2</sub> and TRS were 0.08 and 0.024 ppm respectively. These higher concentrations were expected since the MAMu was positioned very close to the steel works of Dofasco and Stelco and as noted in B171, as soon as the winds shifted to westerlies and increased in speed, these concentrations fell off dramatically to the low ppb level. The glc's of non-methane hydrocarbons (TH-M) ranged between 1 and 2 ppm throughout these periods.

From the analyses of the 24 pertinent 30-minute GC samples, the average of the total hydrocarbon loadings was only 221 ug/m<sup>3</sup> and on the average, 42 specific hydrocarbons (out of a possible 126 compounds) were identified in these samples. The success of identifying the peak areas on these resulting chromatographs was also very good - an average of 73.5%. With respect to the different classes of hydrocarbons and on the average, the alkane fraction comprised 62% (a mean loading of 136 ug/m<sup>3</sup>) of the total hydrocarbon loadings, the alkene fraction 6% (a mean loading of 13 ug/m<sup>3</sup>), the aromatic fraction 24% (a mean loading of 52 ug/m<sup>3</sup>) and the chlorinated organic fraction 5% (a mean loading of 10 ug/m<sup>3</sup>). By far, the most dominant class of organics was the alkanes and within this class, the loadings of the dominant specific hydrocarbons (i.e. propane, butane, 2-methylbutane, pentane, 2-methylpentane and hexane) ranged, on the average, between 7 and 27 ug/m<sup>3</sup>. Similarly the average loadings of the BTX's (benzene, toluene and xylenes), the dominant sub-group of the aromatics, ranged between 10 and 17 ug/m<sup>3</sup>.

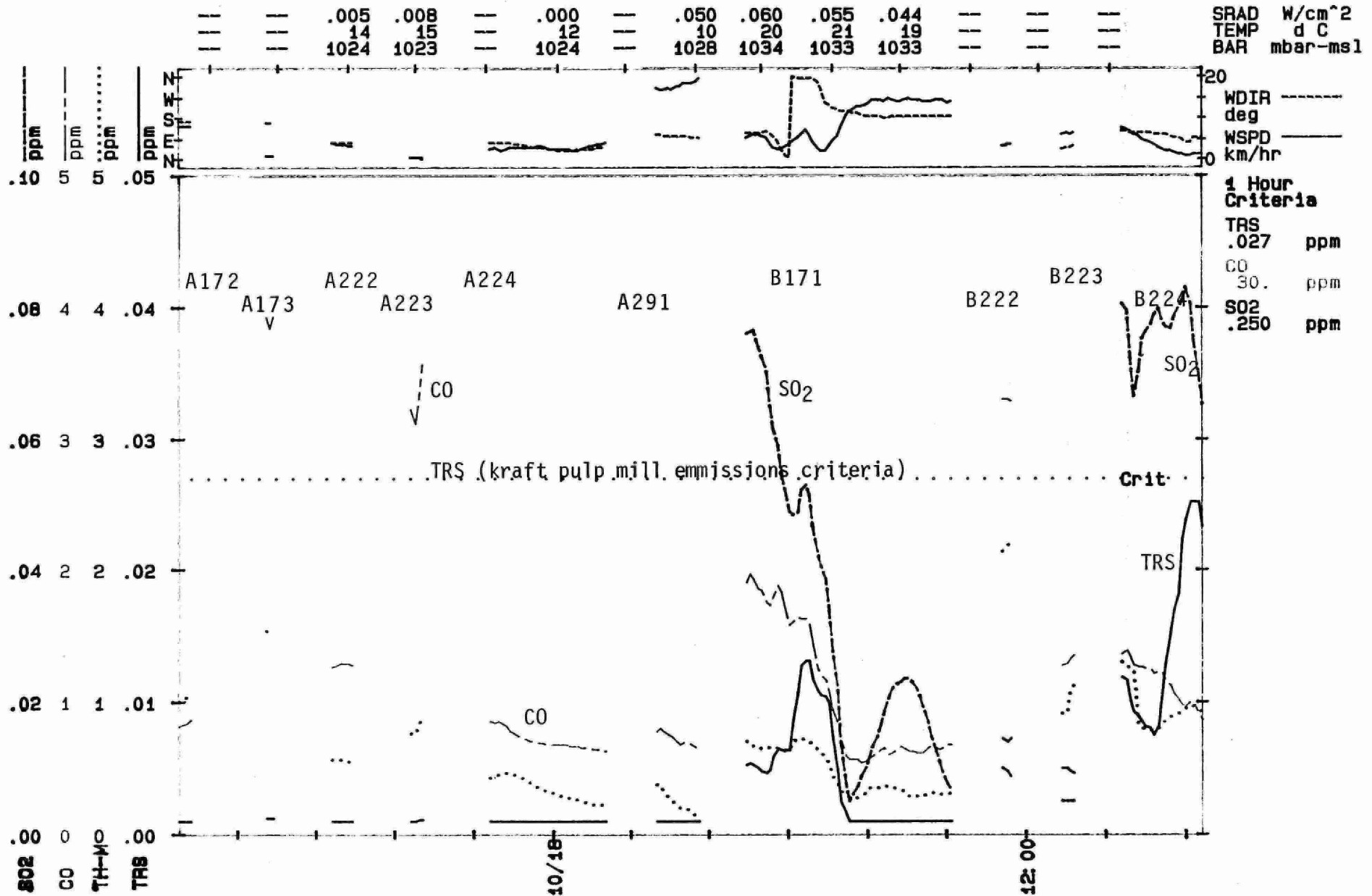
In summary, for measurements acquired under daytime inversion conditions, an increase in the glc's of  $\text{NO}_x$  and CO was noted along with a relative increase in the alkane loadings as compared to the other fractional groups determined from the GC analyses. Thus vehicular traffic emissions are deemed to be the most probable major source of these contaminants.

No environmental standards, criteria or guidelines were exceeded for any of these monitored contaminants during these monitoring periods.



# 

Start: 85/10/17 13:32 Scan: 60 sec. Ave: 60.00 min.  
 Loc: Merging of 10 Monitoring Periods...Inversion Conditions



### 3.3 Stelco/Dofasco

During these three weeks and apart from the overnight/long-term monitoring programme carried out at the Harvester site, 4 days were specifically dedicated to monitoring emissions downwind of the Stelco and Dofasco. These days were October 21, 23, 29 and 30th and because of the prevailing winds and the accessibility, it was very difficult to position the monitoring units downwind of these mills and ascertain with certainty the specific specific impingement zones corresponding to the individual plants. Owing to these factors, only the measurements obtained during monitoring period B303 was indicative of downwind emissions from Stelco whereas the measurements obtained during the other 9 monitoring periods (i.e., A213, A233, A234, A292, A301, A302, B212, B294 and B302) were indicative of emissions from Dofasco.

With respect to the common contaminants monitored downwind of Stelco, 1.2 hours of data were acquired and the only significant concentration measured was that for TRS (total reduced sulphur compounds). The TRS Environmental Guideline (although only applicable to measurements of emissions from the kraft pulp milling process) of 0.027 ppm was exceeded throughout this period. The overall average and maximum 30-minute average ground level concentration (glc) of TRS measured at this time was 0.087 and 0.090 ppm. The odour threshold for this contaminant is approximately 0.005 ppm and the maximum 1-minute average glc measured at this time was 0.17 ppm (34 times this odour threshold). For the other common contaminants, the measured glc's were deemed not to be too significant. For example, the overall average glc's of CO, SO<sub>2</sub>, TH-M, NO<sub>x</sub> and O<sub>3</sub> were only 2.0, 0.08, 0.6, 0.05, and 0.02 ppm respectively.

Only one GC sample was acquired at this downwind Stelco site and its overall total hydrocarbon loading was relatively light - 117 ug/m<sup>3</sup>. Only 19 different organics (out of a possible 124) were identified with the alkane fraction accounting for 22% (26 ug/m<sup>3</sup>) of the total hydrocarbon loadings and the aromatics 77% (90 ug/m<sup>3</sup>). No chlorinated organics were detected in this sample and for the individual alkanes, all concentrations were less than 5 ug/m<sup>3</sup>. For the aromatics, the most dominant sub-group was the BTX's (benzene, toluene and xylenes) with respective loadings of 62, 10 and 11 ug/m<sup>3</sup>. The 30-minute point of impingement Standard for these 3 organics is 10,000, 2,000 and 2,300 ug/m<sup>3</sup> respectively.

With respect to the results obtained downwind of Dofasco, 19 hours of common contaminant data and 23 gas chromatographic samples were acquired.

With respect to the common contaminants and upon comparing with the Stelco results, similar concentrations of  $\text{SO}_2$ , CO and  $\text{O}_3$  were obtained in both cases (i.e. 0.05, 1.9 and 0.02 ppm respectively). Less TRS was measured downwind of Dofasco but still the glc's were in excess of the odour threshold of 0.005 ppm and approached the kraft mill environmental guideline figure of 0.027 ppm. The overall average TRS glc was 0.01 ppm; its maximum 30-minute average glc was 0.027 ppm; and its maximum one-minute average glc was 0.05 ppm (10 times the odour threshold). With overall average glc's of 0.94 and 0.13 ppm respectively, approximately twice as much non-methane hydrocarbons and oxides of nitrogen were measured downwind of Dofasco as compared to Stelco. The maximum 30-minute average glc's of TH-M and  $\text{NO}_x$  were 1.9 and 0.24 ppm respectively.  $\text{NO}_x$  has an applicable Environmental Standard glc of 0.25 ppm whereas no Standard exists for TH-M.

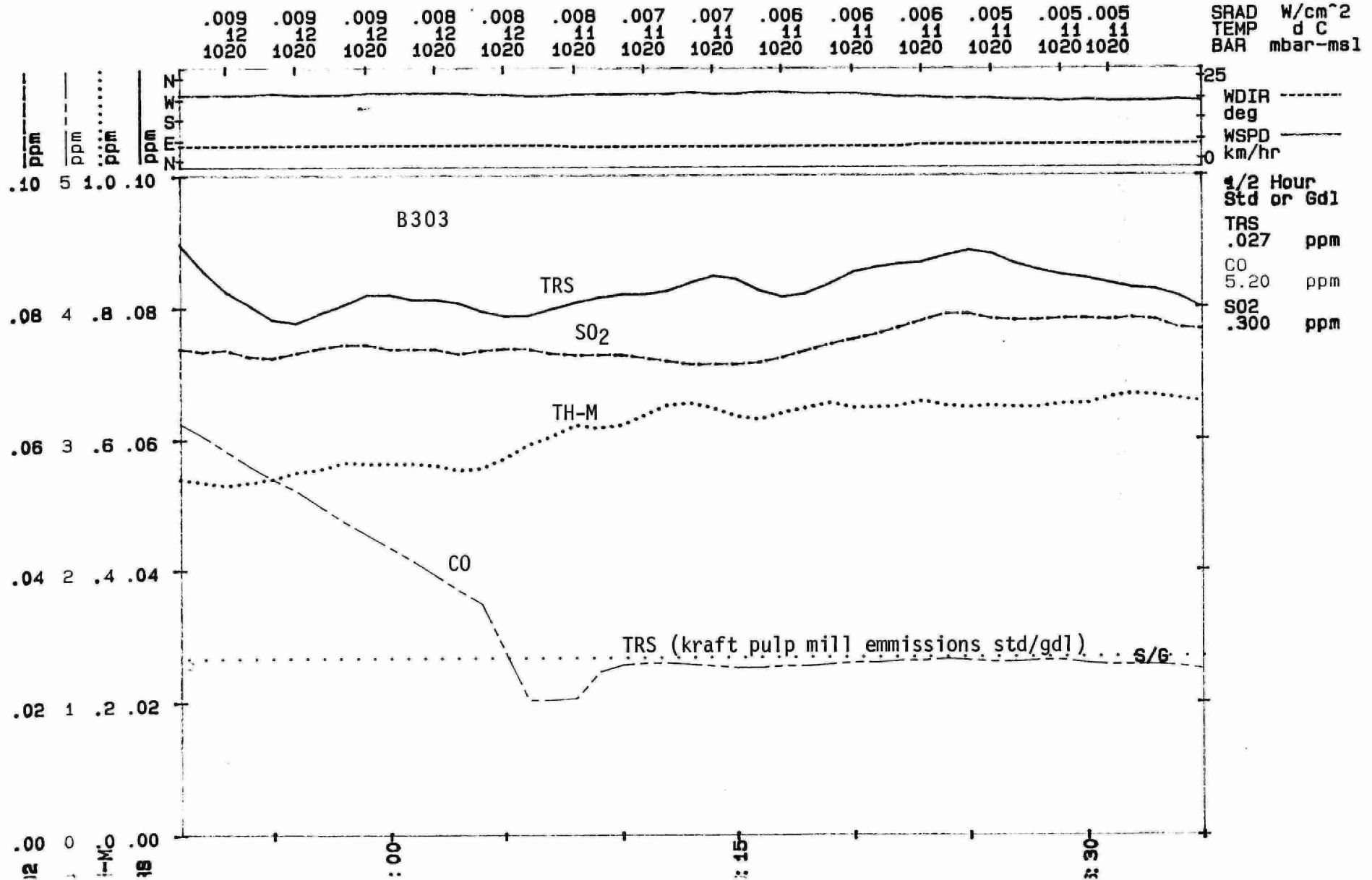
From the analyses of the 22 GC samples acquired downwind of Dofasco, the results were very similar to that obtained downwind of Stelco. The total hydrocarbon loadings ranged from 50 to 225  $\text{ug}/\text{m}^3$  with a mean loading of 122  $\text{ug}/\text{m}^3$ . On the average, the alkane fraction comprised 34% (41  $\text{ug}/\text{m}^3$ ) of these loadings and the aromatics 57% (70  $\text{ug}/\text{m}^3$ ). Small amounts of chlorinated organics were also detected but on the average, they only contributed 2% (an average loading of 3  $\text{ug}/\text{m}^3$ ) of these total loadings. Once again, the specific alkanes were all less than 5 or 6  $\text{ug}/\text{m}^3$  whereas for the specific aromatics, the BTX's were the dominant sub-group. On the average, the loadings of benzene, toluene and xylenes were 33, 12 and 9  $\text{g}/\text{m}^3$ .

In summary, from all of the contaminants measured/monitored downwind of Stelco and Dofasco and as presented in this section, significant glc's of TRS were measured and as for the specific hydrocarbons, no environmental guidelines, standards nor criteria were approached nor exceeded. With respect to the fractional groupings of the hydrocarbons, the aromatic BTX's were the more dominant organics.

Additional data were acquired downwind of Stelco but these were acquired at the Harvester site and as such, will be presented in that section.

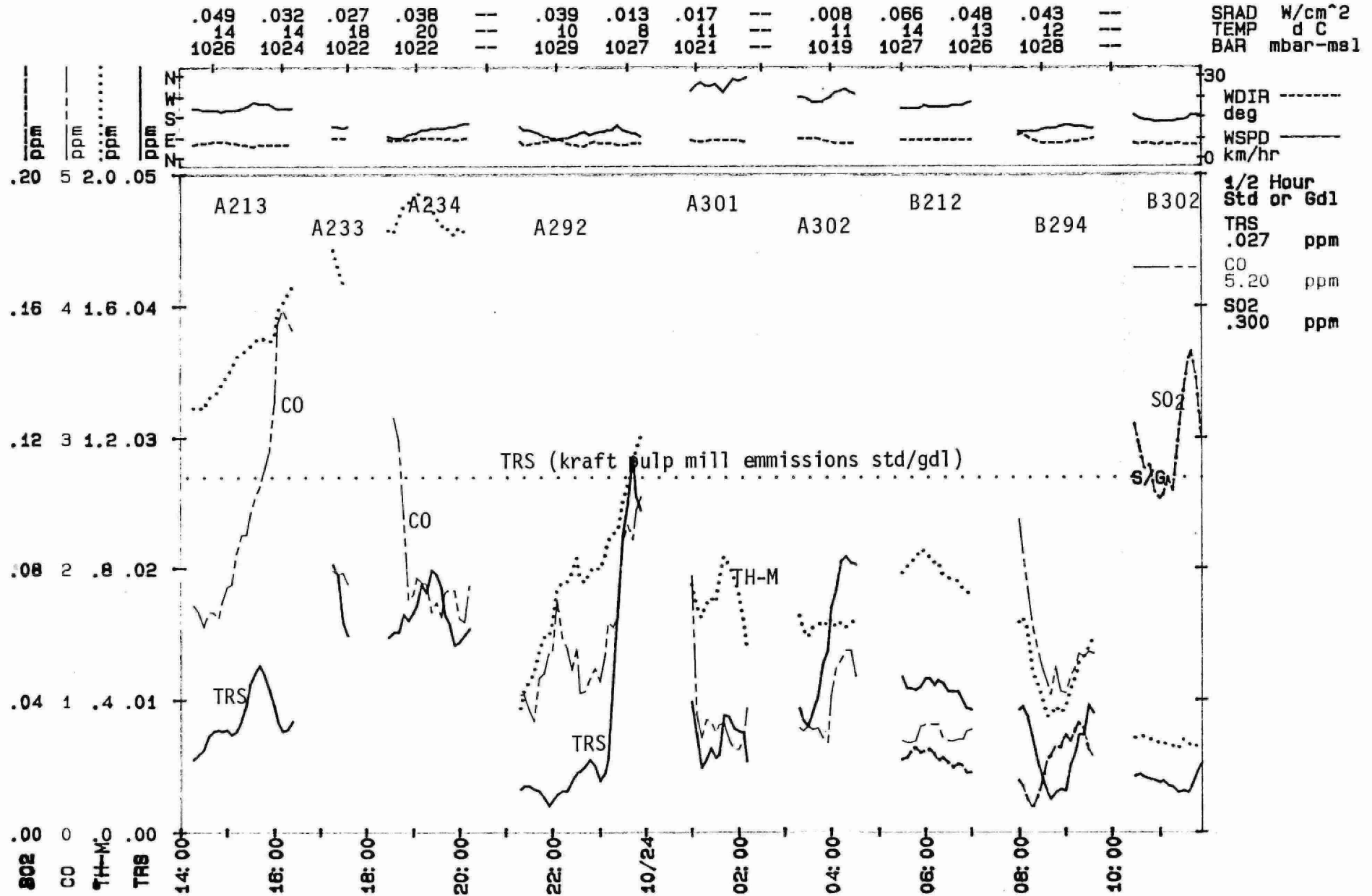
# HAMSTL: M001

Start: 85/10/30 15:21 Scan: 60 sec. Ave: 30.00 min.  
 Loc: Merging of 1 Monitoring Period...downwind of Stelco



# HAMDOF: M001

Start: 85/10/23 13:30 Scan: 60 sec. Ave: 30.00 min.  
Loc: Merging of 9 Monitoring Periods....Downwind of Dofasco



### 3.4 Columbian Chemical

Three monitoring periods (A181, B181 and B293) constituted the investigation of gaseous emissions in the vicinity of this industry. Concurrent sampling was undertaken by MAMu #1 and #2 during October 19th (MAMu #1 upwind and MAMu#2 downwind) and on October 29th, downwind monitoring was carried out by MAMu #2.

For the common contaminants, low concentrations were measured. For example, during the downwind monitoring (2.4 hours of acquired data), the overall average glc's of CO, TRS, SO<sub>2</sub>, NO<sub>x</sub> and TH-M were 1.1, 0.004, 0.09, 0.05 and 0.41 ppm respectively.

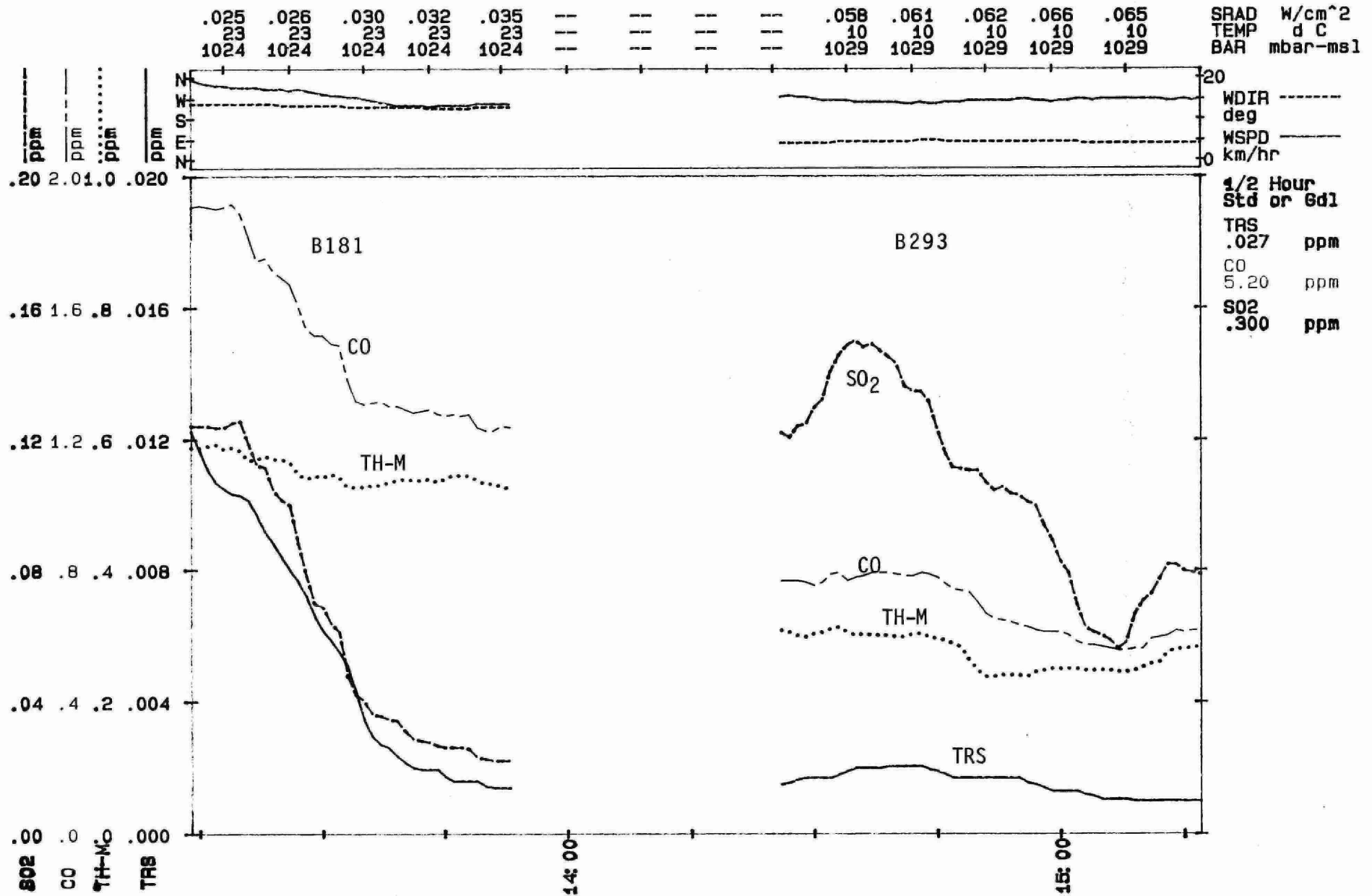
On the day of concurrent monitoring, 3 upwind GC samples and 1 downwind GC sample were acquired. The average total hydrocarbon loading determined from the 3 upwind samples was 109 ug/m<sup>3</sup>. The downwind sample had a total hydrocarbon loading of 343 ug/m<sup>3</sup>. The aromatic fractional loadings were similar in all 4 samples and ranged between 32 and 73 ug/m<sup>3</sup>. The alkane fractional loadings determined from the 3 upwind samples ranged between 24 and 55 ug/m<sup>3</sup> whereas for the downwind sample, this loading was 231 ug/m<sup>3</sup>. The more dominant alkanes determined in the downwind sample were propane (31 ug/m<sup>3</sup>), butane (48 ug/m<sup>3</sup>), 2-methylbutane (48 ug/m<sup>3</sup>) and pentane (34 ug/m<sup>3</sup>). The loadings of these specific alkanes determined upwind of Columbian Chemical were all below 8 ug/m<sup>3</sup>. Similar loadings of the BTX's (benzene, toluene and xylenes) were determined in both the upwind and downwind samples and they were all below 25 ug/m<sup>3</sup>.

On October 29th, the total hydrocarbon loading determined downwind of Columbian Chemical was only 75 ug/m<sup>3</sup>. Once again, the alkane fraction dominated these loadings (59 ug/m<sup>3</sup> or 79% of the total). The magnitudes of these measured organics could or should not be directly compared to the results obtained on October 19th due to different meteorological conditions and presumably different plant operating conditions.

Thus in summary, these measurements inferred that Columbian Chemical was a source of alkane hydrocarbons and very little else and that all measured quantities were very low and no exceedance of the applicable environmental regulations was recorded.

# HAMCOL: M001

Start: 85/10/18 12:44 Scan: 60 sec. Ave: 30.00 min.  
 Loc: Merging of 2 Monitoring Periods...downwind of Columbian Chemical





### 3.5 Sewage Treatment Plant - Brampton Street

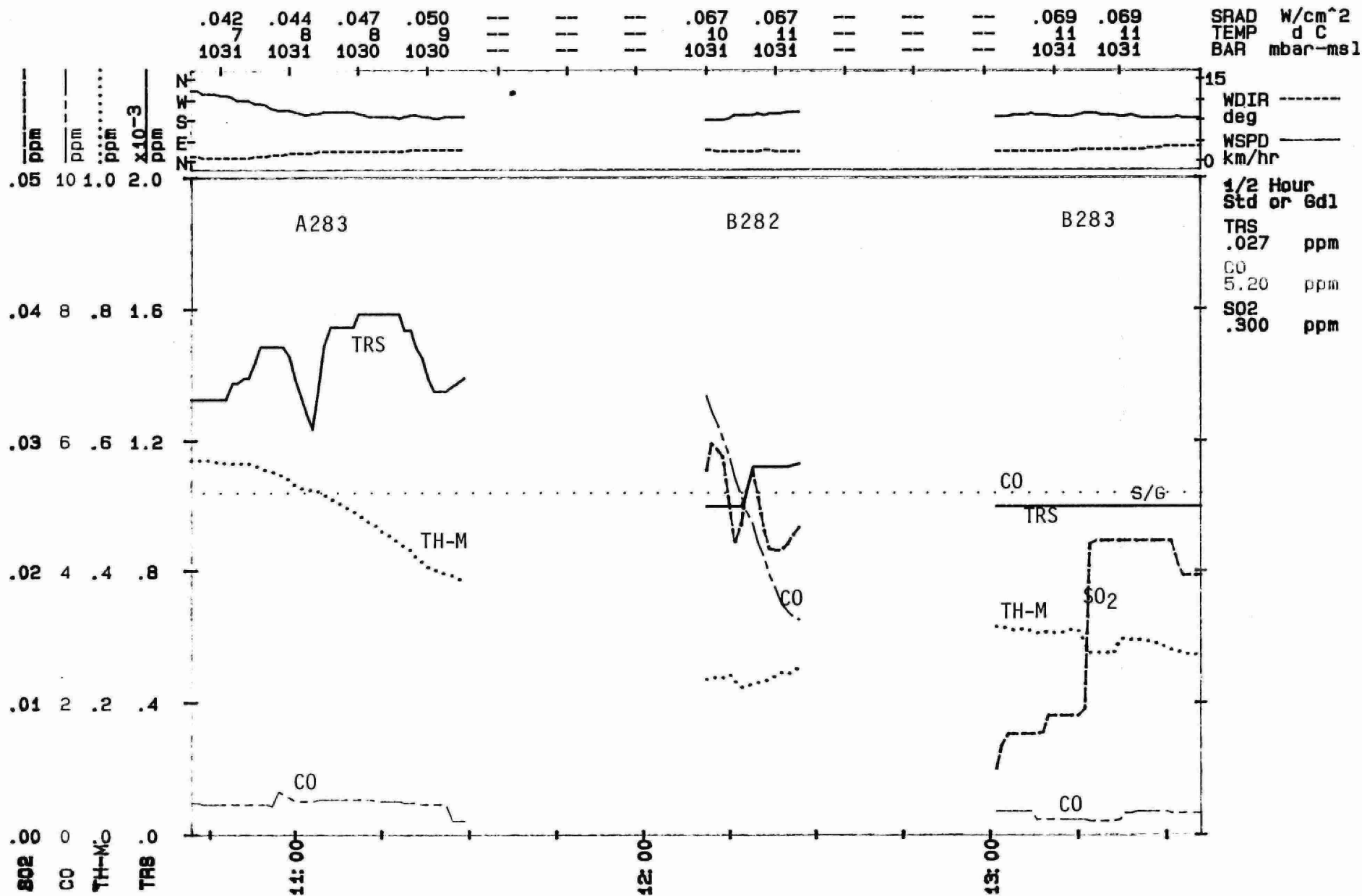
On October 28th, MAMu #1 and #2 were positioned on Brampton Street, just south of Quebec Street and directly downwind of this sewage treatment plant. Approximately 3 hours of ambient air data for the common contaminants and 2 GC samples were acquired at this time.

Apart from carbon monoxide, all measured concentrations of the common contaminants were low. For example, the overall average concentrations of TRS, SO<sub>2</sub>, TH-M and NO<sub>x</sub> were 0.001, 0.02, 0.4 and 0.05 ppm respectively. Initially when MAMu #2 arrived at this downwind area, high concentrations of CO were measured (a maximum 1-minute average was in excess of 10 ppm) but as time passed, these levels dropped significantly and at the end of the first hour, the concentration levels were less than 1 ppm - similar to the concentration values reported by MAMu #1. This information suggests that the sewage treatment plant was not a major source of CO but rather, the suspected primary source was due to local and nearby traffic.

Only MAMu #2 acquired GC samples in this downwind area since both monitoring units were situated within 100 metres of each other. MAMu #2 collected 2 samples and from the resulting analyses, very low loadings were measured. Only 25 to 30 organic compounds were identified (the area percentage identified peak number was 76 to 78%) and the resulting total loadings were only 115 and 91 ug/m<sup>3</sup>. The alkane fraction was the largest and comprised approximately 78% of these loadings whereas the aromatic fraction comprised only 14% of these loadings. No chlorinated organics were detected in either sample.

HAMSEW: M001

Start: 85/10/28 10:12 Scan: 60 sec. Ave: 30.00 min.  
Loc: Merging of 3 Monitoring Periods...downwind of Sewage Treatment Plant



### 3.6 Harvester Site

The Harvester monitoring site located at the north end of Sherman Avenue and just north of Burlington Street was the major long-term/overnight monitoring site for MAMu #2 during this Hamilton'85 ambient air survey. Between October 17th and November 6th, MAMu #2 acquired approximately 381 hours of continuously monitored common contaminant data (during 17 different monitoring periods) and 13 GC samples at this site.

With respect to the common contaminants measured at this site, the overall average ground level concentrations (glc's) of CO, TRS, SO<sub>2</sub>, TH-M, NO<sub>x</sub> and O<sub>3</sub> were determined to be 0.91, 0.008, 0.03, 0.56, 0.04 and 0.02 ppm respectively. Upon examining the short term variations in the concentrations of these contaminants, the concentrations of ozone were relatively low and consistent whereas for the others, significant increases in the glc's were measured. The maximum one-hour average glc's of CO, TRS, SO<sub>2</sub> and NO<sub>x</sub> were 4.7, 0.22, 0.15 and 0.22 pm respectively. The odour threshold for TRS is approximately 0.005 ppm and the maximum 1-minute average glc for this contaminant was 0.29 ppm. From concentration directional analyses, the majority of the SO<sub>2</sub> and TRS originated from the northeast direction - pointing to Stelco as the primary contributor; the majority of the NO<sub>x</sub> originated from the northeast and the south (pointing to Stelco and vehicular traffic as major sources); and with respect to CO, no defined major source direction was noted. Thus for the sulphurous compounds and to some extent the oxides of nitrogen, Stelco was ascertained to be a major source for these contaminants.

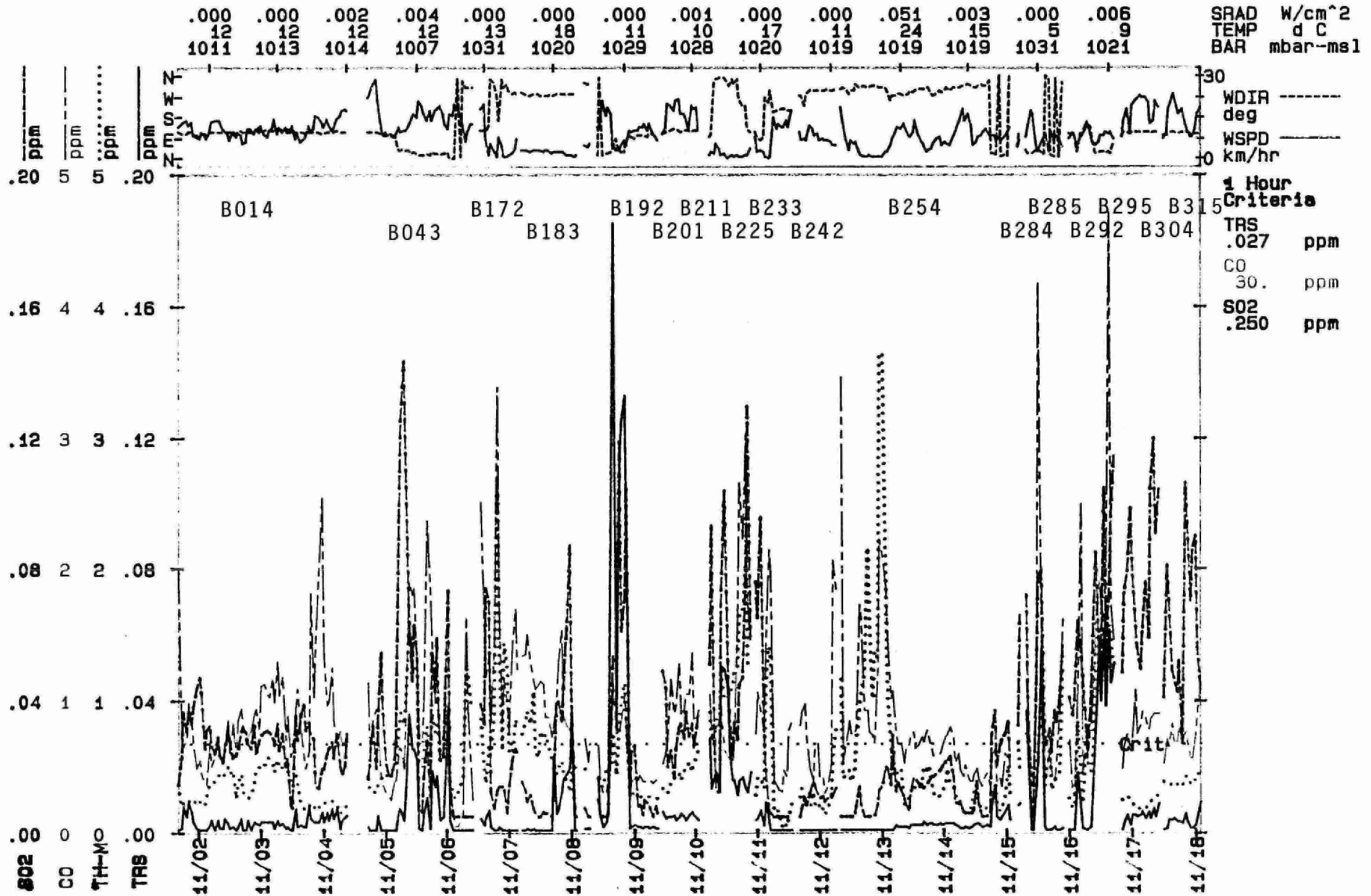
The acquisition of the 13 GC samples was interspersed throughout these 17 monitoring periods and they were usually acquired under adverse weather conditions or poor dispersion conditions (i.e. under inversion conditions, high pollution index episodes, precipitation, etc.) or during the late afternoons or early mornings. Because of these factors, the resulting loadings were somewhat higher than the other samples acquired throughout this survey. From these samples, the total hydrocarbon loadings ranged from 62 to 1611 ug/m<sup>3</sup> with an overall

average loading of  $524 \text{ ug/m}^3$ . From the field GC libraries of 124 specific organic compounds, the average number of compounds positively identified in these samples was only 44 (the range being 30 to 56) but yet a reasonable good accountability was achieved for the peak area count figures - an average of 67% of the total peak area was identified (this range being 52 to 84%). With respect to the total hydrocarbon loadings, the average aromatic fraction accounted for 57% (or  $298 \text{ ug/m}^3$ ) of these loadings and the alkanes 32% ( $170 \text{ ug/m}^3$ ). Only a small amount of chlorinated organics were detected in any of these samples - an overall average loading of  $32 \text{ ug/m}^3$  (6%). For the aromatics, the BTX's (benzene, toluene and xylenes) were the dominant organics and their respective average loadings were 87, 50 and  $49 \text{ ug/m}^3$ . For the alkanes, the dominant organics were butane, 2-methylbutane, pentane, tetrachloromethane, and indan with respective average loadings of 25, 32, 21 57 and  $108 \text{ ug/m}^3$ . Indan (aka. hydrindene) was the major organic detected in these samples and it is a known constituent of coal tar.

In summary, significant glc's of  $\text{SO}_2$ , TRS,  $\text{NO}_x$  and CO were measured at this site. Stelco appeared to be the major contributor of the  $\text{SO}_2$ , TRS and to a lesser degree  $\text{NO}_x$  concentrations whereas vehicular traffic appeared to be the major source of CO. From the GC analyses, higher than usual total hydrocarbon loadings were recorded with the aromatic fraction dominating. However from all of these measurements, no pertinent environmental standard, criterion nor guideline was exceeded.

# HAMHAR: M001

Start: 85/11/01 15:13 Scan: 300 sec. Ave: 60.00 min.  
Loc: Merging of 17 Monitoring Periods...Harvester Site on Sherman



# HAMHAR: M001

Start: 85/11/01 15:13 Scan: 300 sec. Ave: 60.0 min. Duration: 395.5 hrs.

Loc: Merging of 17 Monitoring Periods...Harvester Site on Sherman

## WINDS Blowing From

1 Division = 10% of Time

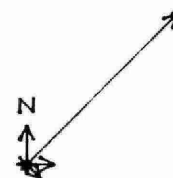
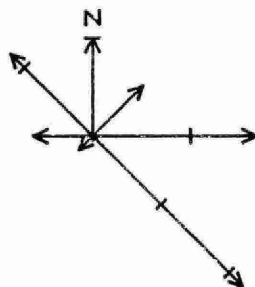
Calm ( < 3 km/hr) = 15.4%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

## TRS Blowing From

1 Division = .1 ppm — A. MEAN



Wind and TRS Roses

# HAMHAR: M001

Start: 85/11/01 15:13 Scan: 300 sec. Ave: 60.0 min. Duration: 395.5 hrs.

Loc: Merging of 17 Monitoring Periods...Harvester Site on Sherman

## WINDS Blowing From

1 Division = 10% of Time

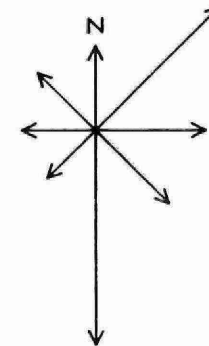
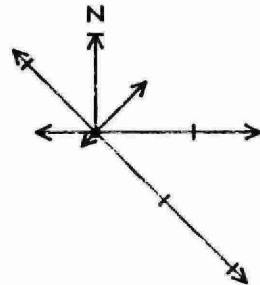
Calm ( < 3 km/hr) = 15.4%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

## NOx Blowing From

1 Division = .1 ppm -- A. MEAN



Wind and NO<sub>x</sub> Roses

# HAMHAR: M001

Start: 85/11/01 15:13 Scan: 300 sec. Ave: 60.0 min. Duration: 395.5 hrs.

Loc: Merging of 17 Monitoring Periods...Harvester Site on Sherman

## WINDS Blowing From

1 Division = 10% of Time

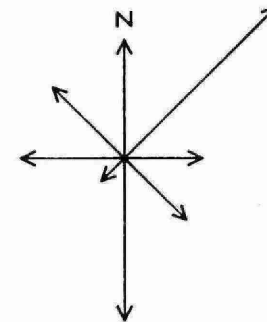
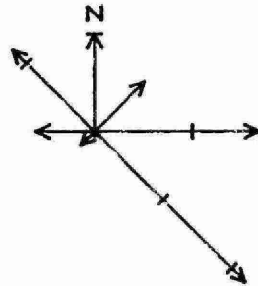
Calm ( < 3 km/hr) = 15.4%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

## Non-CH<sub>4</sub> Blowing From

1 Division = 1 ppm -- A. MEAN



Wind and Non-CH<sub>4</sub> Roses



# HAMHAR: M001

Start: 85/11/01 15:13 Scan: 300 sec. Ave: 60.0 min. Duration: 395.5 hrs.

Loc: Merging of 17 Monitoring Periods...Harvester Site on Sherman

## WINDS Blowing From

1 Division = 10% of Time

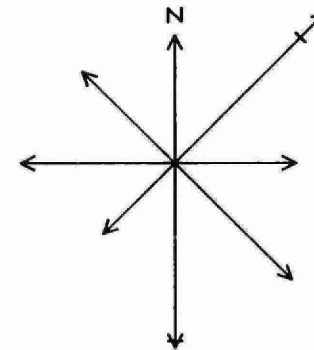
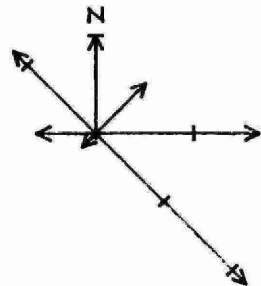
Calm ( < 3 km/hr) = 15.4%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

## CO Blowing From

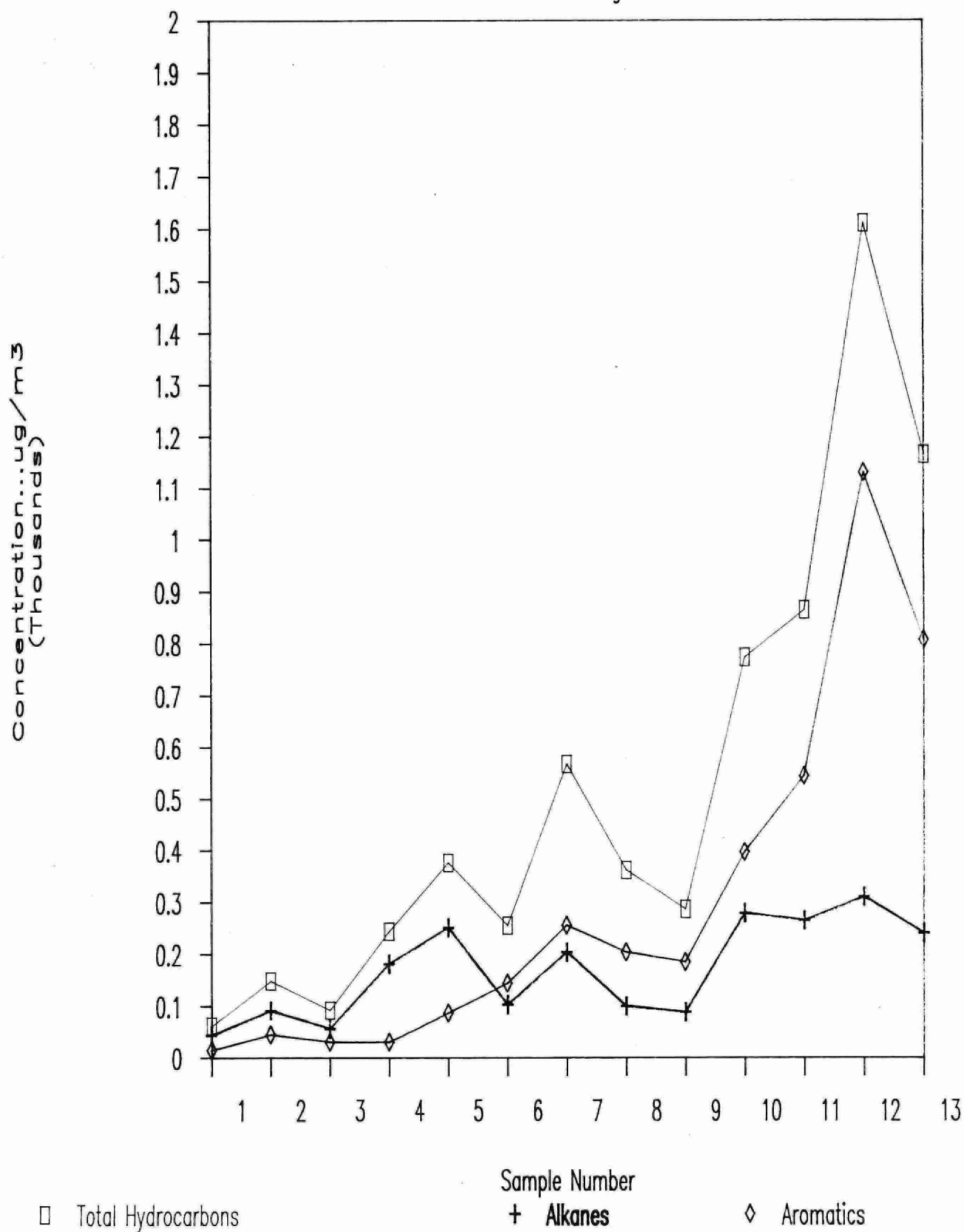
1 Division = 1 ppm -- A. MEAN



Wind and CO Roses

# HAMILTON '85 SURVEY

## Harvester Site Organics



### 3.7 Pier 24/25

Similar to the MAMu#2's utilization of the Harvester site, the Harbour Commission Pier 24/25 site located at the northern end of Strathearne Avenue and just south of the Queen Elizabeth Way was one of two major long-term/overnight monitoring sites utilized by MAMu#1. While at this site, MAMu#1 acquired approximately 219 hours of continuously monitored ambient air data for the common contaminants (during 10 different monitoring periods) and 9 gas chromatographic samples for organic interpretations.

With respect to the common contaminant data and upon comparison with the overall results obtained at the Harvester site, the average glc's of  $\text{NO}_x$ ,  $\text{O}_3$  and CO (i.e. 0.07, 0.01 and 0.87 ppm respectively) were similar to those obtained at the Harvester site whereas there was a marked decrease in the TRS glc's (0.004 ppm at the Pier site and 0.008 at the Harvester site) and a significant increase in the non-methane hydrocarbon glc's (0.9 ppm at the Pier site as compared to 0.56 ppm at the Harvester site). No  $\text{SO}_2$  was monitored at this site and the respective maximum 60-minute average glc's of CO, TRS,  $\text{NO}_x$  and  $\text{O}_3$  were 2.2, 0.026, 0.44 and 0.03 ppm.

With respect to the wind directional frequency analyses performed on the data acquired at this site; calm winds (i.e. less than 3 km/hr) were present for approximately 17% of the time; westerly winds were present for approximately 25% of the time; and southerly winds were minimal. With respect to the concentration directional analyses performed on this same data set: the prominent directions for the TRS readings were from the West (Stelco) and the south (Dofasco and Domtar); for CO, the prominent direction was from the south to west quadrant (vehicular traffic on Burlington Street and emissions from Stelco and Dofasco); and for the non-methane hydrocarbons, the prominent wind direction was from the south (Domtar) and southwest (Dofasco). It is interesting to note that although little or no southerly winds were recorded at this monitoring site, one of the major directions regarding the higher TRS, TH-M and CO measured concentrations was southerly. This implies that the emissions from the main Hamilton industrial complex located to the south of this site spread out over a wide area and eventually impinged at the Pier 24/25 site area.

From the GC analyses of the 9 ambient air samples acquired at this site, low hydrocarbon loadings were measured. On the average, approximately 32 different organics were detected in each sample and the success of matching the resulting chromatograms with the field GC libraries was very good (an average of 75% for the area per cent identified peak figure). From these 9 samples, the average total hydrocarbon loading was only  $75 \text{ ug/m}^3$  (with a range of 18 to  $190 \text{ ug/m}^3$ ) with the alkane fraction comprising approximately 56% ( $42 \text{ ug/m}^3$ ) of these loadings and the aromatic fraction approximately 40% ( $30 \text{ ug/m}^3$ ). Very little chlorinated organics were detected in any of these samples - an average loading of only  $4 \text{ ug/m}^3$ . For the individual common alkanes, all average loadings were less than  $10 \text{ ug/m}^3$  and for the BTX's (i.e. the dominant aromatics: benzene, toluene and xylenes), the loadings were only 17, 7 and  $7 \text{ ug/m}^3$  respectively.

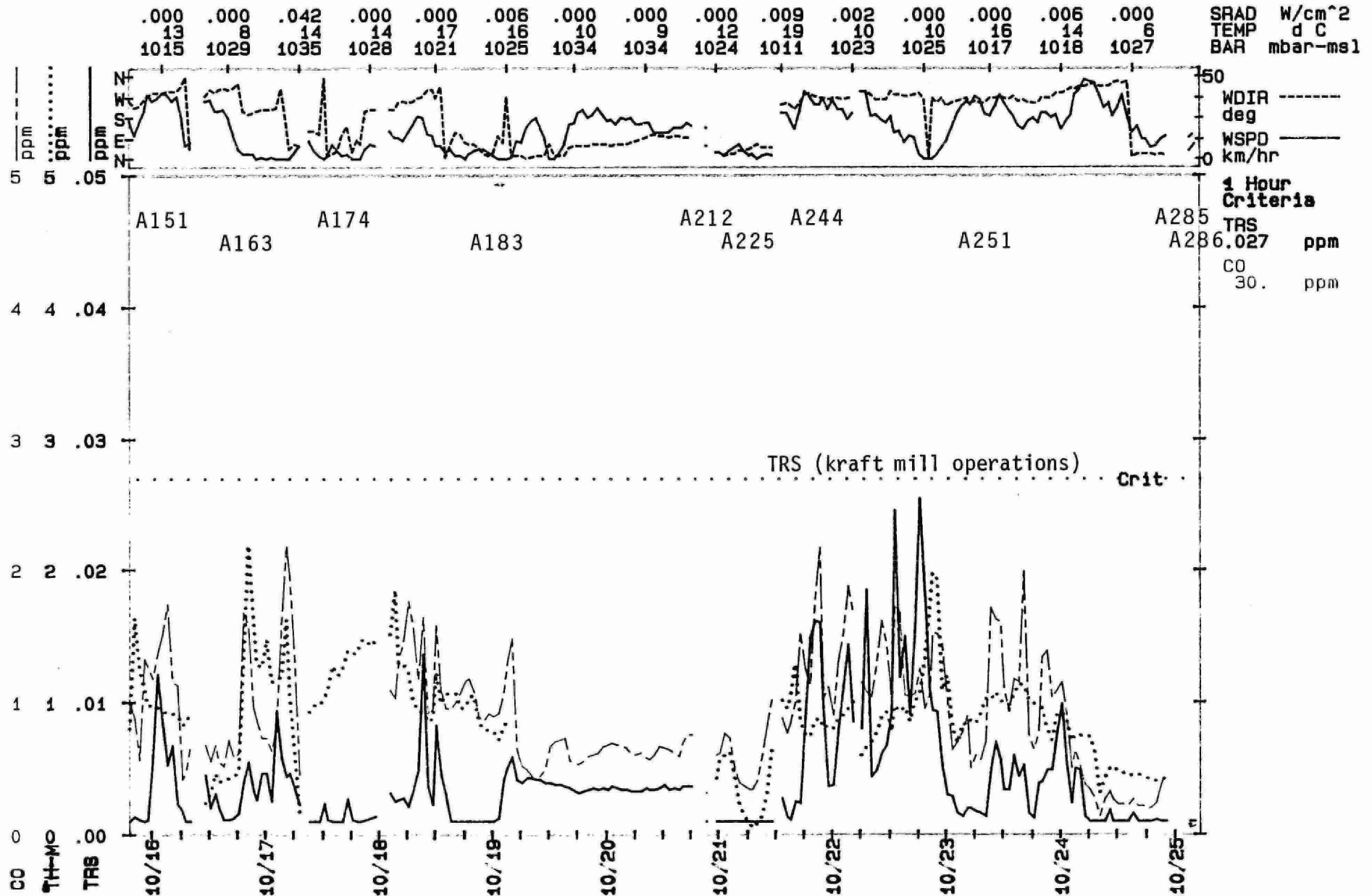
In summary, very low loadings of organics were determined from the GC sampling programme carried out at this site. As for the other contaminants, similar concentrations of  $\text{NO}_x$ ,  $\text{O}_3$  and CO were measured as compared to those obtained at the Harvester site whereas the TRS concentrations were approximately 50% less. No pertinent environmental standard, criterion or guideline was approached or exceeded for any of these measured contaminants.

A final point of note in this data was that although from the continuous monitoring programme, the measured non-methane hydrocarbon concentrations were higher than those reported for the Harvester site, the overall average total hydrocarbon results obtained from the GC sampling programme carried out at this site were much lower (75 versus  $524 \text{ ug/m}^3$ ). The reason for this was that no GC sampling was undertaken at this site during inversion conditions nor at times when the emissions from the industrial area were blowing directly towards this site.

# HAMP24: M001

Start: 85/10/15 18:20 Scan: 300 sec. Ave: 60.00 min.

Loc: Merging of 10 Monitoring Periods...Pair 24/25



## HAMP24: M001

Start: 85/10/15 18:20 Scan: 300 sec. Ave: 60.0 min. Duration: 227.4 hrs.

Loc: Merging of 10 Monitoring Periods...Pier 24/25

### WINDS Blowing From

1 Division = 10% of Time

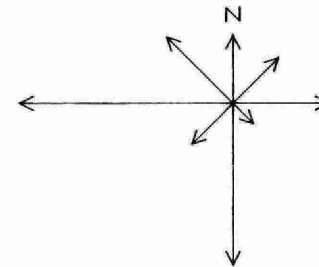
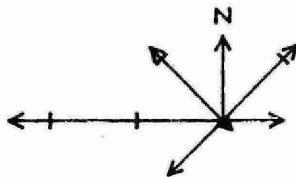
Calm ( < 3 km/hr) = 17.2%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

### TRS Blowing From

1 Division = .01 ppm -- A. MEAN



## HAMP24: M001

Start: 85/10/15 18:20 Scan: 300 sec. Ave: 60.0 min. Duration: 227.4 hrs.

Loc: Merging of 10 Monitoring Periods...Pier 24/25

### WINDS Blowing From

1 Division = 10% of Time

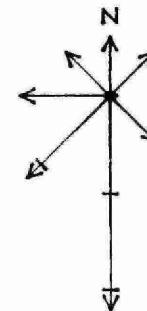
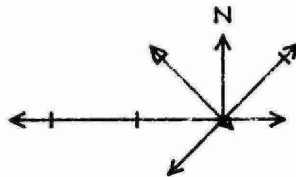
Calm ( < 3 km/hr) = 17.2%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

### Non-CH4 Blowing From

1 Division = 1 ppm -- A. MEAN



Wind and Non-CH<sub>4</sub> Roses

## HAMP24: M001

Start: 85/10/15 18:20 Scan: 300 sec. Ave: 60.0 min. Duration: 227.4 hrs.

Loc: Merging of 10 Monitoring Periods...Pier 24/25

### WINDS Blowing From

1 Division = 10% of Time

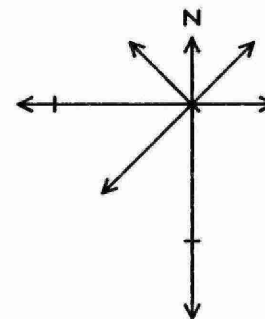
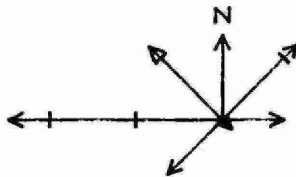
Calm ( < 3 km/hr) = 17.2%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

### CO Blowing From

1 Division = 1 ppm -- A. MEAN

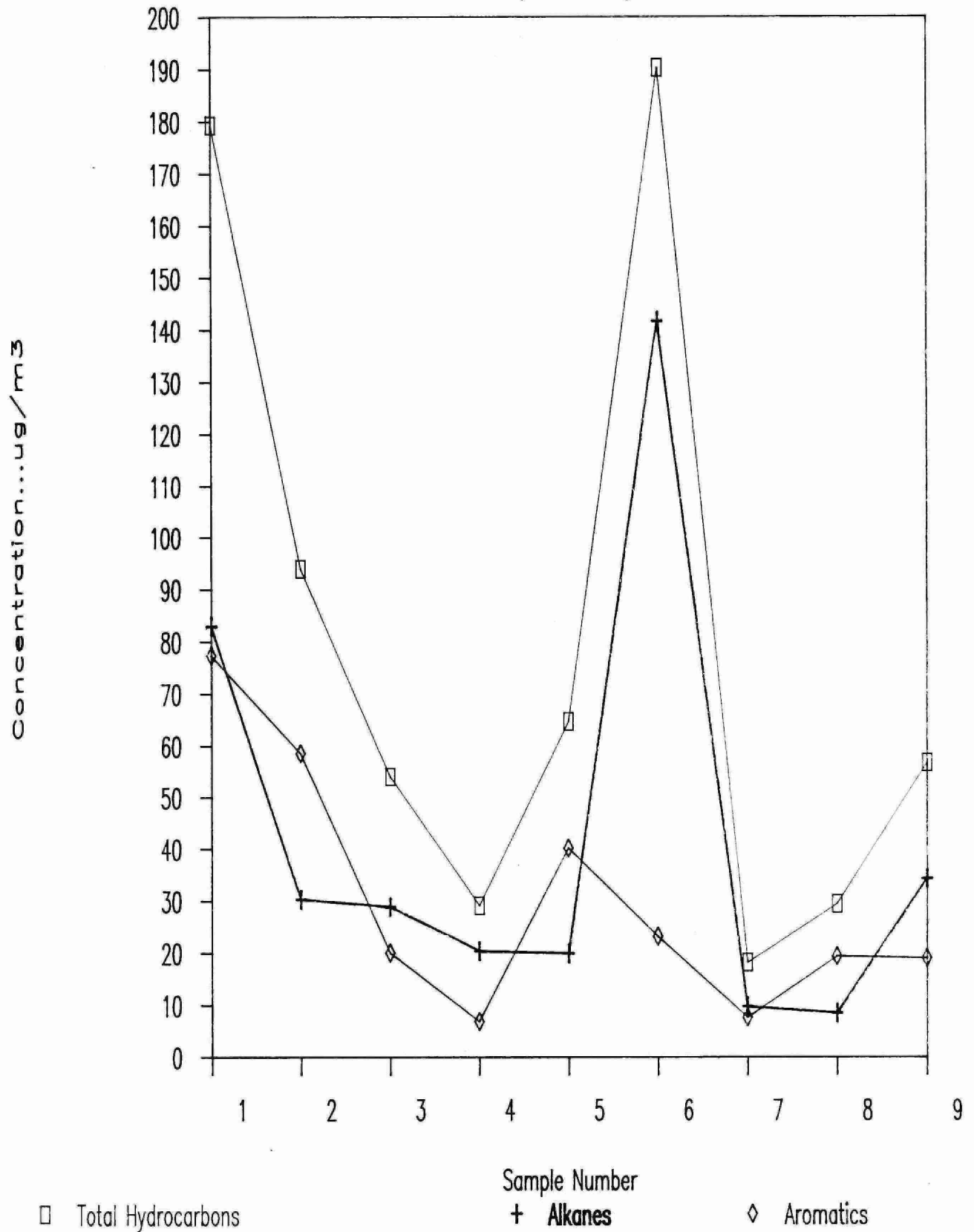


Wind and CO Roses



# HAMILTON '85 SURVEY

## Pier 24/25 Site Organics



### 3.8 Chedoke Area Public Works Department

This site, located at the Hamilton Public Works Department near the corner of Beddoe Drive and Studholme Road and near the Chedoke Civic Golf Club, was the second major long-term and overnight monitoring site utilized by MAMu #1 during this '85 Hamilton Survey. The main reasons for monitoring at this site was to establish some general air quality parameters in the west sector of the city and under relatively long-term calm weather conditions, try and attempt to note any enhancements in the concentration levels of the measured contaminants.

While at this site, MAMu #1 acquired approximately 175 hours of continuously monitored ambient air data for the common contaminants during 8 different monitoring periods. In addition, 3 gas chromatographic (GC) samples were acquired under calm weather conditions and 1 GC sample was acquired under moderate easterly winds.

Relatively low concentration levels were measured for the common contaminants. The overall average glc's of CO, TRS, TH-M, NO<sub>x</sub> and O<sub>3</sub> were 0.72, 0.002, 0.69, 0.10 and 0.01 ppm respectively. Although on the average, these measured concentrations were relatively low, during monitoring periods A013 and A235 some significant glc's of TRS were measured. Under strong easterly winds (20 km/hr), the one-hour average TRS glc's were of the order of 0.005 ppm (A013) and under calm winds (A235), these glc's approached 0.008 ppm. The odour threshold for TRS is approximately 0.004 or 0.005 ppm and the maximum one-minute average glc reported for this contaminant was 0.013 ppm and was acquired during period A235. From the wind analyses performed on the data acquired at this site, the dominant winds were easterly (50% of the time) and/or calm (i.e. less than 3 km/hr for approximately 30% of the time).

For the 3 GC samples acquired during the period of calm wind conditions (i.e. A235), the total hydrocarbon loadings ranged from 267 to 746 ug/m<sup>3</sup> whereas the single sample acquired under moderate easterly winds, the total hydrocarbon loading was only 17 ug/m<sup>3</sup>. Thus under calm conditions, significant hydrocarbon loadings were measured at this site whereas under moderate easterly winds, significant dispersion of the

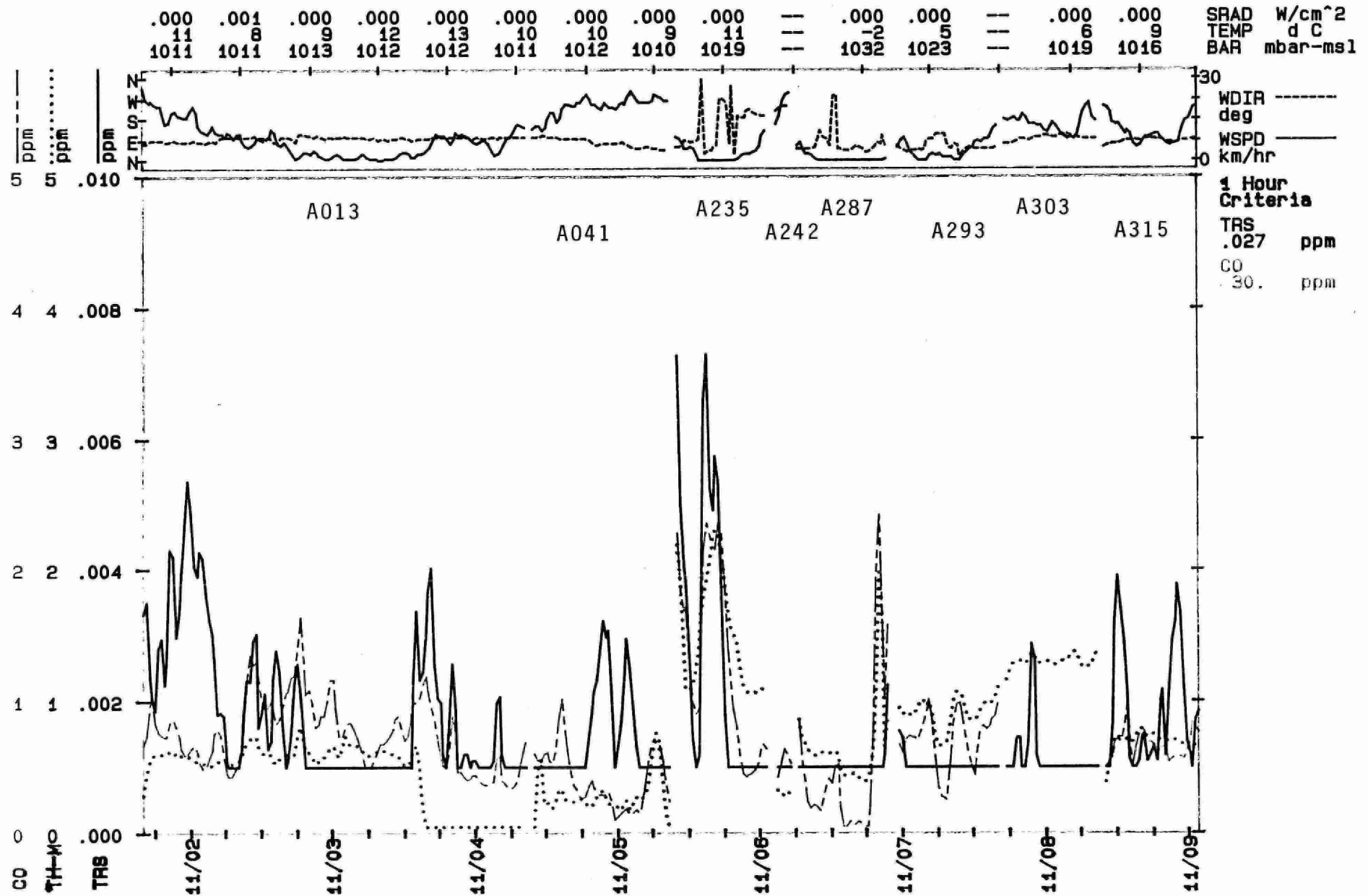
downtown emissions from the industrial area was evident. For the 3 samples acquired under the calm wind condition, the aromatic fractions ranged from 174 to 645  $\mu\text{g}/\text{m}^3$  (or 79% of the total hydrocarbons) and the alkane fractions ranged from 63 to 89  $\mu\text{g}/\text{m}^3$  (or 16%). Fifty-five to 58 different organics were detected in these 3 samples and the area percent identified peak figures were very high at approximately 72%. For the common alkanes, all individual loadings were usually less than 10  $\mu\text{g}/\text{m}^3$  and for the aromatics, the most dominant sub-group was the BTX's (benzene, toluene and xylenes) with average loadings of 24, 35 and 30  $\mu\text{g}/\text{m}^3$  respectively.

The most dominant individual hydrocarbon detected in any of these GC samples was 1,2,4-trimethylbenzene with loadings up to 228  $\mu\text{g}/\text{m}^3$ . However this hydrocarbon co-elutes with tert.-butylbenzene from the GC and the  $\frac{1}{2}$ -hour Environmental Standard for 1,2,4-trimethylbenzene is based solely on the Total Suspended Particulate Standard of 100  $\mu\text{g}/\text{m}^3$ . In other words, the identification and quantification of 1,2,4-trimethylbenzene is ambiguous and the limiting effect is of a suspended particulate nature. The most obvious and plausible source of this contaminant is gasoline in which it can be as high as 4.9% by weight and this is reasonable since the monitoring site was a public works department work/storage area. (See the Common Observation section for additional comments on this co-elution problem with respect to these two organics).

In summary, although some odour was perceived at this site and the source directional analyses clearly pointed to the industrial complex on Burlington Street as being the major source, no environmental regulations (i.e. standards, guidelines nor criterion) were approached nor exceeded for any of these monitored common contaminants during the three weeks of this survey.

# HAMPWD: M001

Start: 85/11/01 15:02 Scan: 300 sec. Ave: 60.00 min.  
 Loc: Merging of 8 Monitoring Periods...Chedoke area Public Works Dept.



# HAMPWD: M001

Start: 85/11/01 15:02 Scan: 300 sec. Ave: 60.0 min. Duration: 178.5 hrs.

Loc: Merging of 8 Monitoring Periods...Chedoke area Public Works Dept.

## WINDS Blowing From

1 Division = 10% of Time

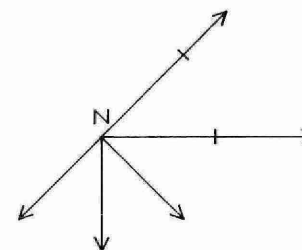
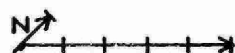
Calm ( < 3 km/hr) = 30.9%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

## TRS Blowing From

1 Division = .001 ppm -- A. MEAN



Wind and TRS Roses

### 3.9 Mohawk College - Fennell Avenue

During this 3-week Hamilton survey, some monitoring was undertaken atop the Hamilton escarpment - namely at Mohawk College. The main purpose for monitoring at this site was to determine contaminant concentrations under westerly winds and during a period of relative calm easterly winds. Under westerly winds, the air mass was supposedly to be very clean whereas under the weak easterly winds, the air mass would be somewhat loaded with the contaminants originating from the industrial complex located at the base of the escarpment.

Three monitoring periods comprised this segment of the Hamilton survey and approximately 34 hours of data for the common contaminants were acquired. No gas chromatographic samples were acquired during the first monitoring period but one sample was acquired during each of the last two periods.

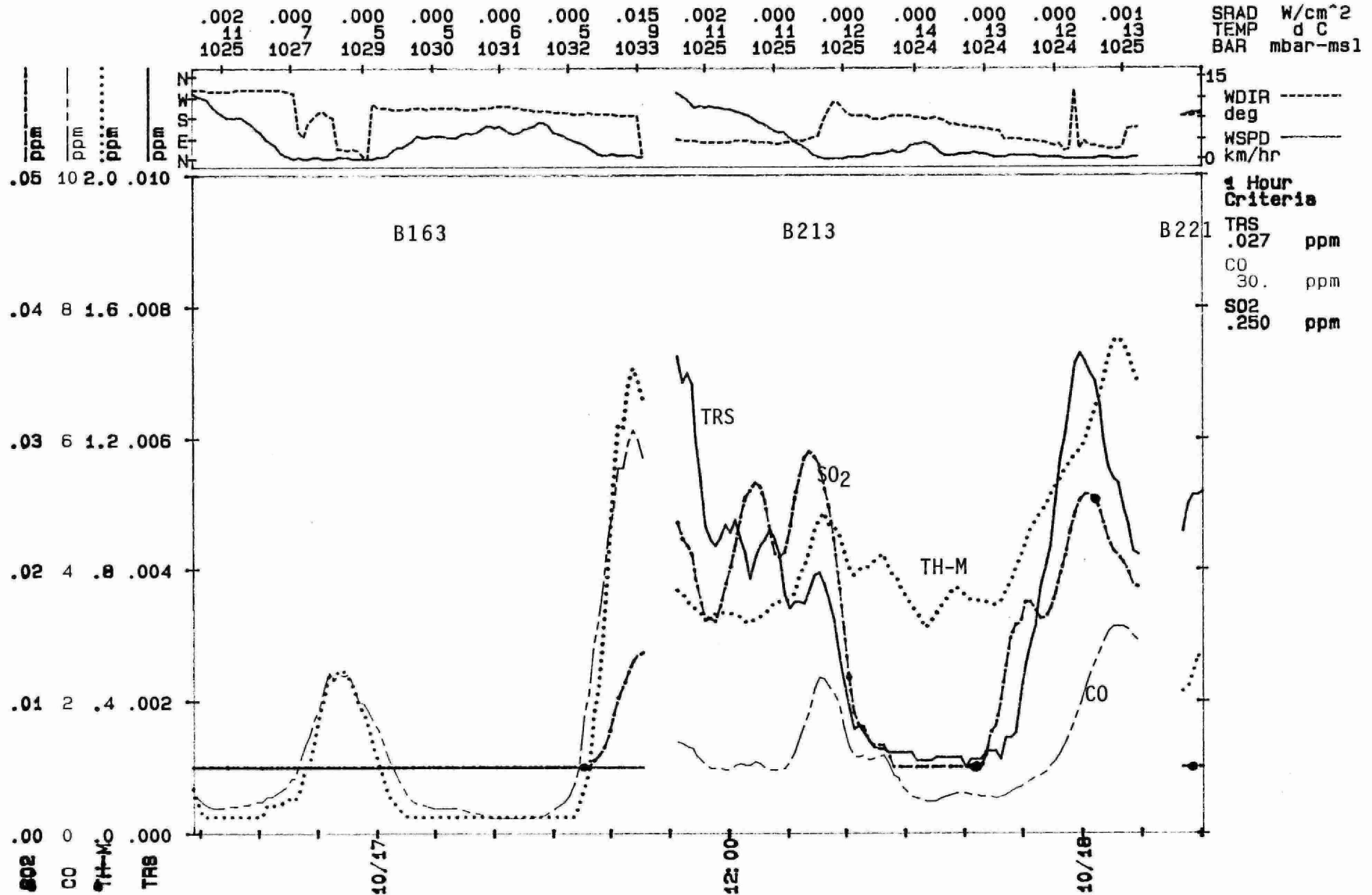
During the first monitoring period and under westerly winds, only background concentrations were measured for the common contaminants (this was an overnight run and the maximum 60-minute average glc's of  $\text{SO}_2$  and TRS were only 0.01 ppm and less than 0.002 ppm respectively). However during second and third monitoring periods under weak easterly winds, significant concentrations of these contaminants were measured. Now the maximum 60-minute average concentrations of  $\text{SO}_2$  and TRS were 0.03 and 0.007 ppm respectively. Similarly, higher concentrations of  $\text{CO}$ ,  $\text{NO}_x$  and TH-M were also recorded during these last two periods; the maximum 60-minute average concentrations being 6.1, 0.32 and 1.5 ppm respectively.

From the analyses of the two GC samples, the total hydrocarbon loadings were relatively light at 75 and 186  $\text{ug/m}^3$  with the alkane fraction accounting for most of the variability (up to 121  $\text{ug/m}^3$ ). The aromatic fractional loading was the same in both samples (at approximately 40  $\text{ug/m}^3$ ) and was comprised almost entirely of the BTX's - at about 10  $\text{ug/m}^3$  for each organic. These points suggest that vehicular traffic was the major source of organics at this site as measured at the time stated.

As shown by the wind/pollution rose analysis for the merged data set of all the common contaminant data acquired at this site, the dominant wind directions were calm (54% of the time), southwesterly (15%), northwesterly (10%) and easterly (12%) and that the dominant direction for the maximum concentrations of TRS were easterly and southerly - i.e. the direction of the industrial complex located at the base of the Hamilton escarpment.

# HAMMOK: M001

Start: 85/10/16 16:45 Scan: 300 sec. Ave: 60.00 min.  
 Loc: Merging of 3 Monitoring Periods...Mohawk College on Fennel Street





# HAMMOK: M001

Start: 85/10/16 16:45 Scan: 300 sec. Ave: 60.0 min. Duration: 35.3 hrs.

Loc: Merging of 3 Monitoring Periods...Mohawk College on Fennel Street

WINDS Blowing From

1 Division = 10% of Time

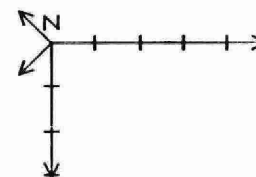
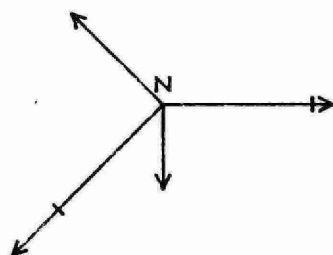
Calm ( < 3 km/hr) = 54.3%

Low ( < 3 km/hr) = .0%

High ( >100 km/hr) = .0%

TRS Blowing From

1 Division = .001 ppm -- A. MEAN



Wind and TRS Roses

Summary of the '85 Hamilton GC work

	DAYTIME INVERSION CONDITIONS			DOFASCO			STELCO	
	AVERAGE	MAXIMUM	SAMPLES	AVERAGE	MAXIMUM	SAMPLES	VALUES OF ONE SAMPLE	
Total Compounds Identified	42.5	68.8	24	42.3	58.8	22	19.8	
Total # of Peaks	74.4	148.8	24	88.1	135.8	22	27.8	
Total Area of Peaks	9886.3	66654.3	24	6499.4	12112.9	22	5847.1	
Area of Identified Peaks	7496.8	53448.2	24	4333.9	7994.4	22	2948.6	
Area % Identified Peaks	73.5	86.8	24	78.8	92.5	22	58.4	
Total hydrocarbons ug/m3:	221.1	1576.3	24	121.8	224.9	22	117.4	
Alkanes ug/m3	136.1	1125.1	24	41.5	87.7	22	25.6	
Cycloalkanes ug/m3	8.9	69.5	24	3.8	8.4	22	8.7	
Alkenes ug/m3	12.7	155.1	24	2.9	7.5	22	1.8	
Cycloalkenes ug/m3	8.4	4.8	24	8.4	1.3	22	8.8	
Alkynes ug/m3	.8	8.6	24	8.8	8.8	22	8.8	
Aromatics ug/m3	51.7	128.4	24	69.8	167.8	22	98.1	
Chlorinated alkanes ug/m3	6.8	37.7	24	2.9	16.4	22	8.8	
Chlorinated alkenes ug/m3	2.7	45.2	24	8.4	8.4	22	8.8	
Chlorinated aromatics ug/m3	8.7	2.7	24	8.8	8.8	22	8.8	

	COLUMBIAN CHEMICAL			SEWAGE TREATMENT PLANT		HARVESTER SITE (mainly Stelco)		
	AVERAGE	MAXIMUM	SAMPLES	VALUES OF TWO SAMPLES		AVERAGE	MAXIMUM	SAMPLES
Total Compounds Identified	43.6	52.8	5	38	25	43.5	56.8	13
Total # of Peaks	78.2	128.8	5	43	31	73.6	187.8	13
Total Area of Peaks	5612.4	8115.3	5	4184.4	3871.2	19212.1	53345.3	13
Area of Identified Peaks	3899.2	6886.5	5	3176.2	2398.7	12388.8	33452.6	13
Area % Identified Peaks	68.2	81.4	5	75.9	78.1	66.9	83.8	13
Total hydrocarbons ug/m3:	148.9	342.6	5	115.4	98.7	523.8	1611.1	13
Alkanes ug/m3	82.6	238.8	5	88.5	71.5	169.7	318.6	13
Cycloalkanes ug/m3	5.7	18.4	5	5.6	3.8	18.8	24.3	13
Alkenes ug/m3	6.4	19.1	5	3.3	4.3	13.5	25.7	13
Cycloalkenes ug/m3	8.5	1.1	5	8.8	8.8	8.8	8.8	13
Alkynes ug/m3	8.8	8.8	5	8.8	8.8	8.8	8.8	13
Aromatics ug/m3	46.7	73.8	5	17.1	12.8	297.8	1138.3	13
Chlorinated alkanes ug/m3	5.5	22.6	5	8.8	8.8	29.9	117.4	13
Chlorinated alkenes ug/m3	8.4	1.5	5	1.8	8.8	8.6	2.8	13
Chlorinated aromatics ug/m3	1.2	2.6	5	8.8	8.8	8.8	8.8	13

Summary of the '85 Hamilton GC work

PIER 24/25 SITE

CHEDOKE PUBLIC WORKS DEPT.

MOHAWK COLLEGE SITE

	AVERAGE	MAXIMUM	SAMPLES	AVERAGE	MAXIMUM	SAMPLES	VALUES OF TWO SAMPLES	
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Total Compounds Identified	31.7	45.8	9	47.3	58.8	4	38.8	47.8
Total # of Peaks	56.8	119.8	9	95.8	122.8	4	49.8	62.8
Total Area of Peaks	3928.5	18763.5	9	13653.8	24426.8	4	6881.5	8658.9
Area of Identified Peaks	2765.6	6881.8	9	9759.9	17172.3	4	3666.8	6728.8
Area % Identified Peaks	74.6	91.2	9	71.9	74.6	4	53.3	77.7
<hr/>								
Total hydrocarbons ug/m3:	79.5	198.3	9	367.5	745.9	4	74.9	185.6
Alkanes ug/m3	41.8	141.7	9	59.8	89.4	4	28.1	121.2
Cycloalkanes ug/m3	1.6	4.1	9	7.5	18.7	4	1.7	4.9
Alkenes ug/m3	2.2	9.5	9	4.1	6.9	4	6.1	6.5
Cycloalkenes ug/m3	8.2	1.2	9	8.7	1.1	4	8.8	8.8
Alkynes ug/m3	8.8	8.8	9	8.1	8.4	4	8.8	8.8
Aromatics ug/m3	38.2	77.3	9	287.6	645.3	4	38.9	48.2
Chlorinated alkanes ug/m3	1.7	9.1	9	5.9	9.4	4	8.8	11.4
Chlorinated alkenes ug/m3	1.1	9.9	9	8.8	8.8	4	8.8	1.8
Chlorinated aromatics ug/m3	1.1	1.7	9	8.8	8.8	4	8.8	8.5

#### 4. CONCLUSIONS

This '85 Hamilton ambient air survey was carried out between October 15 and November 6th. Sixty-four monitoring periods comprised this survey and approximately 860 hours of continuous monitored data for the common contaminants (such as CO, TRS, SO<sub>2</sub>, NO<sub>x</sub>, O<sub>3</sub> and THC) and 82 gas chromatographic samples for analyses of specific hydrocarbons were acquired.

This data was presented and discussed under the following headings and are thus summarized.

(a) Inversion Conditions

- 10 monitoring periods; 22 hours of common contaminant data and 24 GC samples.
- increased glc's of NO<sub>x</sub> and CO were noted
- increased alkane fraction of the total hydrocarbon loadings was noted
- no pertinent environmental standards, criteria or guidelines were exceeded for any of the measured contaminants
- these data implied that the increases were due mainly to vehicular exhaust.

(b) Stelco/Dofasco

- 1 monitoring period; 1.2 hours of common contaminant data and 1 GC sample was acquired downwind of Stelco. (additional Stelco monitoring is presented in the Harvester site discussion).
- 9 monitoring periods; 19 hours of common contaminant data and 23 GC samples were acquired downwind of Dofasco.
- similar concentrations of SO<sub>2</sub>, CO and O<sub>3</sub> were measured downwind of Dofasco and downwind of Stelco - the overall respective average glc's being 0.05, 1.9 and 0.02 ppm
- for TRS, the maximum 30-minute average glc's measured downwind of Stelco was 0.090 ppm and downwind of Dofasco 0.027 ppm
- the maximum 30-minute average glc's of TH-M and NO<sub>x</sub> measured downwind of Stelco were 0.65 and 0.05 ppm and downwind of Dofasco, they were 1.9 and 0.24 ppm respectively
- similar hydrocarbon loadings were obtained downwind of Stelco and Dofasco. The aromatic fraction dominated in both cases and the more prominent were the BTX's (benzene, toluenes and xylenes) in the range of 10 to 60 ug/m<sup>3</sup> inclusive
- none of the pertinent environmental guidelines, criterion or standards were exceeded for any of the measured contaminants, although the

0.027 ppm kraft pulp mill standard for TRS was exceeded and several odour threshold concentration levels for other contaminants were also exceeded.

(c) Columbian Chemical

- 3 monitoring periods; 4 hours of common contaminant data and 4 GC samples were acquired downwind of this suspected source
- low concentrations of the common contaminants were measured.
- low total hydrocarbon loadings were determined of which, the alkane fraction dominated
- none of the pertinent environmental guidelines, criterion or standards were exceeded for any of the monitored contaminants.

(d) Sewage Treatment Plant on Woodward Avenue

- 2 monitoring periods; 3 hours of common contaminant data and 2 GC samples were acquired downwind of this suspected source
- except for CO, all measured concentrations for the common contaminants were low. The primary suspected source of CO was deemed to be vehicular traffic - the maximum 1-minute average glc was in excess of 10 ppm
- from the hydrocarbon analysis, the loadings were low and the alkane fraction dominated. No chlorinated organics were detected in either sample.
- no environmental guidelines, criterion or standards were exceeded for any of the monitored contaminants.

(e) Harvester site

- this was the major long-term and overnight monitoring site utilized by MAMu #2
- 17 monitoring periods; 381 hours of common contaminant data and 13 GC samples were acquired at this site
- although the overall average glc's of the common contaminants were low, significant short-term increases were measured. In particular SO<sub>2</sub> and TRS; the maximum 1-hour average glc's were 0.15 and 0.216 ppm respectively and the source direction pointed to Stelco as the major contributor. A similar statement is made with respect to NO<sub>x</sub> (its maximum 1-hour average glc was 0.22 ppm)
- the 13 GC samples were acquired under poor atmospheric dispersion conditions and as such, the loadings were somewhat higher (up to

1611 ug/m<sup>3</sup>) than other samples acquired throughout this survey. The aromatic fraction dominated the total hydrocarbon loadings. The most prominent hydrocarbon detected in any of these samples was indan with an average loading of 108 ug/m<sup>3</sup> - it is a known constituent of coal tar.

- no environmental guideline, criterion or standard was exceeded for any of the monitored contaminants.

(f) Pier 24/25

- this was one of two major long-term and overnight monitoring site utilized by MAMu #1
- 10 monitoring periods; approximately 219 hours of common contaminant data and 9 GC samples were acquired at this site.
- similar overall concentrations of the common contaminants (except for TRS) were measured at this site as compared to the results obtained at the Harvester site. Sulphur dioxide was not measured at this site.
- the maximum 1-hour average glc of TRS was 0.026 ppm and the prominent source directions were west (Stelco) and south (Dofasco and Domtar).
- very low hydrocarbon loadings were determined from the GC samples with equal contributions from the alkane and aromatic fractions. It should be noted that no GC samples were acquired at this site during inversion conditions or when the winds were blowing from the industrial area.
- no pertinent environmental standard, criterion or guideline was exceeded for any of the measured contaminants.

(g) Public Works Department - Chedoke area

- this was the second major long-term and overnight monitoring site utilized by MAMU #1
- 8 monitoring periods; approximately 175 hours of common contaminant data and 4 GC samples were acquired at this site
- usually low concentrations of the common contaminants were measured although some sulphurous odors were perceived (the maximum one-hour average glc of TRS was 0.005 ppm). The industrial complex along Burlington Street was determined to be the most plausible source of these odours.

- 3 of the GC samples were acquired under poor atmospheric dispersion conditions and 1 under good dispersion conditions. Under poor dispersion conditions, the hydrocarbon loadings ranged from 267 to 746  $\mu\text{g}/\text{m}^3$  whereas under good dispersion conditions, the loading was only 17  $\mu\text{g}/\text{m}^3$ .
- the aromatic fraction dominated the total hydrocarbon loadings. The most abundant hydrocarbon was determined to be 1,2,4-trimethylbenzene with loadings up to 228  $\mu\text{g}/\text{m}^3$ . Since this hydrocarbon co-elutes with tert.-butylbenzene, the exact quantification is somewhat ambiguous. The environmental standard for 1,2,4-trimethylbenzene is based on the particulate standard of 100  $\mu\text{g}/\text{m}^3$  and it is also a major component of gasoline. The most obvious source of this contaminant is the public works yard itself.
- apart from 1,2,4-trimethylbenzene, no pertinent environmental standard, guideline or criterion was exceeded for any of the measured contaminants.

(h) Mohawk College

- 3 monitoring periods; approximately 34 hours of common contaminant data and 2 GC samples were acquired at this site.
- under westerly winds, only background concentrations were measured for the common contaminants
- under weak easterly winds, some sulphurous odours were perceived and the maximum 1-hour average glc's of  $\text{SO}_2$  and TRS were 0.03 and 0.007 ppm respectively.
- from the GC analyses, low loadings were determined and the alkanes were the dominant fractional group
- vehicular traffic and some emissions from the industrial complex located at the base of the escarpment were deemed to have been measured at this site.
- no pertinent environmental standard, guideline or criterion was exceeded for any of the measured contaminants acquired at this site.



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